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(Assisted by several Scientific Gentlemen.)

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No. CCXXIX.

RECENT PATENTS.

To WALTER WESTRUP, *of Wapping, in the county of Middlesex, miller and biscuit baker, for improvements in cleaning and grinding corn or grain, and dressing meal or flour.*—[Sealed 24th January, 1850.]

THIS invention relates, in the first place, to an improved construction of apparatus for cleaning and separating corn or grain from dust and other extraneous matters, such as smut-balls, the seeds of weeds, and broken or defective grains. The wheat or other grain, in passing through the apparatus, is also cleansed, and polished, and freed from the smut and dust which adheres to the beard of the grain, and which it has hitherto been so difficult to remove.

The second improvement relates to machinery for grinding corn or grain, and consists, in the first place, in making the running-stones with conical grinding surfaces, in place of flat ones, as is usually the case. In this improved arrangement, the bottom stones are the runners,—the upper stones being stationary, and made in the form of a ring, with inclined inner surfaces, so as to fit, and, as it were, to surround the bottom stones or runners. The runners of both pair of grinding stones are mounted, one above the other, on the same vertical shaft, and are arranged in such a manner that the first pairs will break down the corn or grain, and partially pulverize it; the meal then passes from the first pair of stones into a kind of short dressing-machine, where the fine flour is separated from the unground meal, which passes between the

second pair of stones, where it is completely ground. By this means the corn is passed through the mill in much less time than usual, and thereby an increased amount of work, in a given time, is effected. The grinding surfaces being conical, also facilitate the delivery of the flour therefrom, and thus prevent it from being spoilt or damaged by heating from friction.

The third part of the invention relates to an improved construction of apparatus for dressing meal or flour, or separating the flour from the bran or offal. The arrangement of parts for effecting the desired object is very similar, in principle of construction, to the apparatus employed for cleaning and polishing the grain, and included under the first head of the invention.

In Plate I., fig. 1, represents a longitudinal vertical section of the cleaning apparatus complete. The corn or grain to be operated upon is raised from any receptacle below by means of the lifting apparatus seen at A, and is deposited in the inclined spout *a, a,* down which it passes into the interior of the large horizontal cylindrical apparatus. This apparatus is composed of a perforated cylinder B, B, mounted on an inclined shaft *b, b, b,* by means of the arms *c, c, c.* The perforations of the cylinder B, B, are of two kinds, viz., oblong slits and circular holes, through which broken or defective grains, dust, smut-balls, and the small seeds of weeds can pass with facility; but which will not allow of the passage of sound grains of wheat or corn. The axle or shaft *b, b,* is mounted in suitable bearings; and at one end is a pulley or band-wheel *d,* which, when actuated by any prime mover, communicates rotary motion to the cylinder B. This cylinder is surrounded by a stationary cylinder or casing *e, e,* which receives all the matters that pass through the perforations of the cylinder B. The inner cylinder is slightly inclined, to allow the grain from the spout *a,* to pass slowly along from end to end of the cylinder by its own gravity. On the outer surface of the cylinder B, are longitudinal ribs *f, f, f,* extending from end to end of the cylinder; and these ribs are furnished with a series of inclined wipers *g, g,* which, as the cylinder rotates, gradually push onward, towards the delivery-spout *h, h,* the defective grains, seeds, dust, and other extraneous matters which have passed through the perforations of the cylinder B. From the spout *h,* the offal, resulting from the cleaning operation, falls into a bin D, from whence it passes down a second spout *i,* into a receptacle below. The corn or grain, thus separated from many of the extraneous substances

with which it was before commingled, then falls from the end of the cylinder B, on to an endless travelling-belt or cloth *j*, which conveys it to the hopper or funnel *k*, of the smut-machine, which consists of an upright cylinder C, C, made of sheet-iron, and roughened inside, something like a nutmeg-grater, as seen at C*, in the drawing. The corn from the travelling-cloth *j*, falls on to a conical table or plate *l*, which is secured to the vertical shaft *m*, near its upper end. The surface of this table or plate *l*, is fluted, serrated, or roughened, as shewn in the drawings; and, as the shaft *m*, is caused to rotate by means of the gearing below, the surface of this plate *l*, is made to rub against the under sides of the fixed brushes *n*, *n*, which, as the corn or grain falls on to the table or plate *l*, from the hopper, will rub it with considerable force against the roughened surface of the plate. The corn, after this operation, will fall over the edges of the plate *l*, on to a flat or horizontal circular table *o*, of which there are several, mounted one above another on the vertical shaft *m*. These circular tables are made of wood, and covered with roughened sheet-iron, as shewn at fig. 2, (which represents a plan view of one of them detached). Vertical fans or arms *p*, *p*, (of which there are four between every two tables *o*, *o*,) are secured to the upright shaft *m*, *m*, and are covered with roughened sheet-iron, similar to the tables. Immediately below the edges of each of the tables *o*, and inside the cylinder C, is a wooden ring or annular rib *q*, also covered with roughened sheet-iron. It will now be seen that the corn or grain, upon entering the machine, is first operated upon by the brushes *n*, *n*, which rub it smartly against the rough surface of the conical plate *l*, from which it falls on to the rough surface of the first table *o*; from thence it is thrown, by the centrifugal force produced by the rapid rotation of the shaft *m*, against the rough sides of the cylinder C. The grain then falls between the periphery of the table *o*, and the inclined edge of the ring or annular rib *q*, where it is again rubbed; and, when it escapes therefrom, it will be struck by the vertical fans *p*, and be again thrown against the roughened surface of the cylinder C; or it will fall on to the second table *o*, and will pass between the periphery of this and the inclined edge of the second ring *q*, to be again rubbed; and so on until it reaches the bottom or stationary floor of the machine. It is then swept by the rotary brushes *n**, down a spout *h**, into a chamber, where it is operated upon by a powerful current of air, produced by the fan or blower *r*; and thus all the dust and offal that has been removed from the corn during the operations

A 2

just described is blown away, and conducted by a pipe either into the open air or elsewhere. The clean grain will then fall on to an inclined sieve or perforated plate B*, through which the smaller grains will pass, while the larger and perfect grains will slide down the pipe A*, and fall into a suitable receptacle below.

The patentee remarks that, in practice, he has sometimes found it desirable to pass the corn through a cylinder, similar to that shewn at C, in order to break the smut-balls, and partially cleanse the corn, before carrying it into the perforated cylinder B. In order, however, to avoid complexity, he has not thought it necessary to shew this in the drawings, as it will be easily understood that, after passing the corn through such a machine, it can be raised by the lifting apparatus A, to the spout *a*, of the perforated cylinder B, as already mentioned.

The improved arrangement of apparatus for grinding corn or grain is shewn in several views in Plate I.;—fig. 3, being a vertical section, taken through the middle of the machine; fig. 4, a plan or partial sectional view, taken in the line 1, 2, of fig. 3; and fig. 5, a sectional plan view of the machine, taken in the line 3, 4, of fig. 3. In this arrangement two pairs of stones are employed: the lower stones E, E, are the runners, and are fixed, one above the other, on a hollow vertical shaft F, which turns in bearings made in the framework. The grinding surface of the stones E, is conical or inclined, and lateral holes are made in the stones from the eye to the grinding surface (as shewn at fig. 3, and also in the sectional plan view, fig. 6,) for the purpose of admitting air to the grinding surface, in order to keep it cool. To facilitate this operation, the driving-shaft F, is made hollow, and is supplied with air by a pipe from above;—the air being admitted to the eye of the stone by means of lateral holes, communicating with the interior of the shaft. The top stones G, G, are stationary, and are of an annular shape; their grinding surfaces being inclined to correspond with the conical surface of the runner or bottom stone. For the convenience of adjustment, the upper stones are mounted in annular frames *s*, *s*, which are, by means of projecting pieces 1, 1, 1, (see figs. 4, 5, and 7,) supported upon a stationary ledge 2, 2, 2, which is secured to the framing. The mode of mounting and adjusting the top stone will be best understood by referring to the detached view, fig. 7, which represents, in elevation, the parts in immediate connection with the stones. It will be seen, upon referring to this figure, that the parts of the

ledge 2, 2, 2, upon which the projecting pieces 1, 1, 1, of the annular frames *s*, *s*, rest, are inclined; so that, by merely turning the frame *s*, *s*, slightly round horizontally, the stone may be adjusted to the surface of the runner with the greatest nicety. In order to effect this adjustment, a small toothed rack *t*, is made on the outside or periphery of the annular frame *s*, *s*; and this rack gears into an endless screw *u*; on one end of which is mounted a bevil pinion or mitre-wheel. This wheel is driven by a similar pinion on the upper end of a vertical shaft *v*, which is actuated by means of a similar pair of mitre-wheels and the hand-wheel *w*. The operation, mode of mounting, and adjustment of the lower pair of stones, is precisely similar to the upper; and therefore no separate description is required. The apparatus is fed with corn to be ground by the pipe H; and the feed is regulated by a sliding pipe or tube *x*, which encloses the bottom of the feed-pipe, and may be moved up and down by a lever *y*, the opposite extremity of which is jointed to a long rod *z*, threaded at its lower end, and furnished with a hand-wheel and thumb-screw; whereby the rod *z*, may be raised or lowered, and the feed regulated at pleasure, by bringing the lower edge of the sliding tube *x*, nearer to or further from the circular plate 3, in the feed-box. The amount of feed having been properly adjusted, by the means just described, the corn will pass down the pipe *x*, into the feed-box, and from thence down the pipe 4, into the box 5, immediately above the eye of the upper stone. From this box 5, the corn will pass between the grinding surfaces of the stones G, and E, and will be broken down and partially pulverized. The meal will quickly find its way out from between the stones, and will fall down on to the conical inclined surface 6, 6; from whence it will pass into a wire cylinder I, I, in which a number of brushes 7, 7, similar to those of a dressing-machine, work. These brushes 7, 7, are mounted on the main shaft F, and rotate with it; and as the meal falls into the cylinder, they will brush the already pulverized flour through the fine meshes of the wire, and allow it to fall down the inclined surface 8, 8, into a chamber J, below (shewn best at fig. 7,); while the partially-ground meal will fall down the inclined surface 9, 9, and pass between the second pair of stones (as shewn at fig. 3). By this second operation the meal will have become completely ground or "softened down;" and when it escapes from the second pair of stones it will fall into the chamber J, into which the flour, from the previous grinding operation, has already fallen. It will be understood that the object of separating the flour from the meal, after the first grinding operation, is,

that the flour already produced may not be allowed uselessly to pass through the second pair of stones. At the bottom of the chamber J, is a table K, which is mounted on the vertical driving-shaft, and receives a rotary motion therefrom. The meal, as it falls on to this revolving table K, is, by the rotation of the latter, brought against the arm 10, (see figs. 7, and 8,) which sweeps it into the spout 11; from whence it falls into a bin or receptacle below. To the under side of the revolving table K, are attached a number of sweeps or curved arms (shewn by dots at fig. 8,) whereby any meal that may get under the table is swept out into the spout 11, as the table K, rotates. It is almost unnecessary to state, that the principal working parts are enclosed by a casing N, made of canvas, for the purpose of preventing the flour from being blown about. Motion is communicated to the working parts by means of the bevil gearing shewn at L, L, fig. 3, which is actuated by any prime mover.

The improvements which relate to machinery for dressing meal or flour, and constitute the third part of the invention, are applicable to that description of dressing machinery in which the cylinder is placed vertically or nearly so. Fig. 9, is a horizontal section, and fig. 10, a vertical section of the improved construction of dressing-machine. The novelty consists in the employment of a series of circular tables *o, o, o*, which are mounted on the vertical shaft *m*, between the sets of brushes. The meal is fed into the machine at top, and falls on to the first table *o*, from which it is thrown by centrifugal force against the wire-gauze or silk sides of the cylinder C, through which the fine flour is forced by the brushes *p*. Such portion of the meal as escapes the action of the first set of brushes falls over the edge of the first table *o*, on to the inclined edge of the ring *q*, which shoots it on to the second table *o*, when the second set of brushes operate upon it; and so on, during the whole series, until all the flour is separated from the meal, and forced through the meshes of the cylinder C,—leaving nothing but bran or offal inside at the bottom of the cylinder. It has been said that the meal, in its passage through the machine, falls over the edge of one table *o*, on to the inclined ring *q*, and from thence on to the next table or that immediately below. In practice, however, this is not exactly correct; as, when the machine is driven at a proper speed, the brushes will rotate so fast, that they will catch a considerable portion of the meal before it has time to reach the second table. A great objection to the vertical machines, as at present constructed, is the very great speed at which they are obliged to be driven,—thereby occasioning a loss

of power. Another objection is the liability of a quantity of the meal passing through the machine undressed, should the speed be suddenly slackened from any cause. By the present arrangement these inconveniences are obviated, as there is no occasion to drive the machine at a greater speed than the ordinary oblique cylinders are driven; because there is no danger of any meal getting through the machine undressed, as it cannot pass the first table even if the machine were to stop altogether. The machine is enclosed in an outer casing M, M, and the fine flour that is passed through the gauze or silk is conveyed away in the ordinary manner. The offal from the interior of the cylinder is swept down a pipe or passage *h**, by means of the rotating brushes *n**.

The patentee claims, Firstly,—in relation to machinery or apparatus for cleaning corn or grain, the use of a perforated cylinder, such as that shewn at B, B, fig. 1, for the purpose of separating the perfect corn or grain from the seeds of weeds, and from dust, smut-balls, and other extraneous matters. He also claims the apparatus for cleaning corn or grain shewn at C, C*, fig. 1, in so far as regards the employment of a series of horizontal tables or plates, mounted one above another upon a vertical shaft, which is furnished with radial blades or fans and revolves within an upright cylinder, provided with annular ribs, projecting from the inner side of the cylinder, just beneath the edge of each horizontal table; so that when the corn is fed in at the top of the machine, it will fall on to the first horizontal table, from which it will be thrown by centrifugal force against the side of the cylinder; and, after being rubbed between the edge of the table and the inclined edge of the first annular rib, will fall on to the second table, from which it will in like manner be thrown against the side of the cylinder; and so on, until the corn reaches the bottom of the cylinder; and after being subjected to the action of a fan or blower, for the purpose of blowing away and removing the dust and other impurities, it will be ultimately delivered into a suitable receptacle in a clean state. In reference to machinery for grinding corn or grain, he claims, Secondly,—the use of French buhr mill-stones, formed with conical or inclined grinding surfaces, as above described: that is, with the runner or lower stone made in the shape of a frustrum of a cone,—the upper stone being stationary, and made in the form of a ring, with an inclined grinding surface to correspond with the conical surface of the runner. And he also claims the general arrangement and combination of parts herein described, and shewn at fig. 3;—particularly the use of two or

more pairs of mill-stones with conical or inclined grinding surfaces; the runner of each pair being mounted on the same vertical shaft, and arranged in such a manner, that when the meal escapes from the first pair of stones it may be subjected to a dressing operation, for the purpose of separating the already formed flour from the unground meal, as above described; leaving the unground meal, when freed from the flour, to pass through the second pair of stones, to complete the grinding operation. Thirdly,—in reference to machinery for dressing meal or flour, he claims the use of the horizontal circular tables *o*, *o*, and the annular ribs *q*.—[*Inrolled July,* 1850.]

To Gustavus Palmer Harding, *of Bartlett's-buildings, in the City of London, artificial florist, for improvements in the manufacture of buttons and other fastenings.*—[Sealed 12th June, 1850.]

This invention consists in improvements in manufacturing fastenings for buttons, studs, brooches, and such like articles, for the purpose of securing the same to garments or fabrics without the necessity of sewing.

In Plate III., figs. 1, shew a back view and transverse section of a small button, having one of the improved fastenings applied thereto; and figs. 2, exhibit similar views of a larger button of a different construction. The fastening consists of a piece of wire *a*, bent into the form of a spiral or volute, attached at its inner end (by soldering, screwing, or other means) to the back of the button, but having its outer end free. The button is secured to the garment or fabric by inserting the outer end of the wire into a small hole formed therein, and turning the button round until the whole of the curved part of the wire has passed through the hole, as shewn at figs. 2, where the dotted lines *b*, indicate the garment or fabric: the hole may be sewn round with thread like an ordinary button-hole, or it may be lined with metal in the same manner as the common metal eyelet-holes. Fig. 3, is a back view of a large hook, provided with one of the improved fastenings; and fig. 4, represents a back view of a brooch, which has one of these fastenings secured to it. Figs. 5, and 6, are edge views of a button made with an ordinary metal shank, which is to be attached to the garment or fabric by means of the fastening *c*, formed by bending a piece of wire or strip of metal in the manner shewn.

The patentee claims the mode of constructing the fastenings

in combination with buttons, studs, brooches, and such like articles, as described in respect to figs. 1, 2, 3, 4, 5, 6; and he also claims the mode of making fastenings for buttons with shanks, as described in respect to figs. 5, and 6.—[*Inrolled December*, 1850.]

To WILLIAM PALMER, *of* 14, *Cottage-grove, Bow-road, in the county of Middlesex, Gent., for improvements in the manufacture of candles and candle-wicks, and in the machinery applicable to such matters.*—[Sealed 22nd May, 1850.]

THIS invention relates, first, to the manufacture of candles; secondly, to the manufacture or preparation of wicks; and, thirdly, to apparatus for manufacturing or preparing wicks.

The improvement in the manufacture of candles consists in the employment, for that purpose, of wicks which have been deprived of all moisture by saturating them with tallow, or other fatty matter, or oil, in a heated state. The tallow, fatty matter, or oil, is heated to from 300° to 350° Fahr., and the wicks are kept immersed therein for about ten minutes; and at the expiration of this time they are taken out and permitted to cool. Care should be taken to keep the wicks straight whilst cooling; for, whatever be the position in which they are allowed to become cool or set, they will turn in a corresponding manner in the act of burning.

Several improvements in the manufacture or preparation of wicks are described;—the object of each improvement being to cause the wick to turn out of the flame whilst burning, and thus to render the operation of snuffing unnecessary. The first improvement consists in giving such a set to the wick as will cause it to turn out of the flame, by winding it helically around a cylindrical rod, about a quarter of an inch in diameter, and then dipping it into hot tallow, fatty matter, or oil. The wick may be pulled straight either before or after it has become cool; but it will still have the required tendency to turn out of the flame.

The second improvement consists in winding two wicks helically, in opposite directions, around two separate rods; these rods are to be inserted in two holes, through which they will fall as the wicks are unwound therefrom; and then the wicks are to be unwound from the rods and passed together through hot tallow, whereby they become combined into a double wick. The double wick, when cold, is to be cut

into suitable lengths for making candles; and such lengths or wicks, when intended to be used for making dip candles, must be securely held at each end, until, by the process of dipping, a coat of tallow has been formed thereon of sufficient thickness to retain the wicks in an extended state: when the wicks are used for making mould candles, they are, of course, securely held at each end.

The third improvement consists in making tubular looped wicks for candles. The patentee states that the best mode of performing this part of his invention is to employ a tube about half an inch in diameter, with pins fastened thereon, as shewn in plan and side views at figs. 1, Plate II. This apparatus is similar to what has been used in making tubular looped fabrics or cords for other purposes: he does not, therefore, claim the same,—this part of the invention consisting in making cottons in the form of tubular looped fabrics, suitable for wicks of candles; and he prefers to employ pins of different sizes, to get an inequality of fabric, so as to cause it to turn out of the flame when burning. To form a wick, he takes a cotton cord or cotton yarn, and forms a slip-loop over each pin; he then passes the cotton round and slips the loops already made over the end of each pin, and so forms another series of loops. In some cases, such hollow looped fabrics are made over an inner wick of cotton, in order to get a larger substance of wick. The mode of making hollow looped wicks may be varied.

The apparatus for preparing wicks, which constitutes the third part of this invention, is represented at figs. 2, and 3,—fig. 2, being a plan view, and fig. 3, a transverse section thereof. It consists of a cylindrical rod *a*, about a quarter of an inch in diameter and eighteen inches long, mounted in a frame *b*, in such manner as to be capable of turning freely therein. *c*, is a wire or strip of metal, which is wound helically around the rod *a*, and is fixed at each end, by nuts *d*, to the frame *b*. *e*, is a toothed wheel, fixed on the rod *a*, and receiving motion, through other wheels, from any suitable first mover. A wick *g*, is wound around the rod *a*, between the coils of the helix *c*; after which the frame is placed in a trough (partly shewn at *f*,) containing melted tallow, so that the wick is immersed in the same; and the rod *a*, being then caused to rotate, will deliver the wick at the end a^1, at the same rate that it winds on the wick at a^2. This operation is continued until the whole length of wick has passed through the melted tallow and around the rod *a*, and has thus acquired a suitable set or tendency to turn out of the flame.

The patentee claims, First,—the improvements in the manufacture of candles above described. Secondly,—the improvements in the manufacture of wicks above described. Thirdly,—the improvements in machinery, above described, for manufacturing wicks.—[*Inrolled November,* 1850.]

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, civil engineer, for an invention of improvements in machinery or apparatus for making hat-bodies and other similar articles,—being a communication from abroad.*—[Sealed 29th January, 1850.]

THE improved machinery or apparatus for making hat-bodies and other similar articles is shewn in several views in Plate I. Fig. 1, is a plan view of the machine, with the "former" removed; fig. 2, is a longitudinal vertical section, taken at the line *z, z,* of fig. 1; fig. 3, is a vertical section of the former, with a bat on it, wrapped around with a felt cloth, and covered with a perforated metal cap, and with a perforated metal shield within the former; and figs. 4, and 5, are separate views of the cap and shield.

The patentee remarks, that it has long been essayed to make hat-bodies by throwing the fibres of fur, wool, or other similar materials, by means of a brush or picker cylinder, on to a perforated former, which must be exhausted by a fan below, so as to carry and hold the fibres on the former by the currents of air that rush from all directions towards and through the apertures of the former to the interior thereof, and thus form a bat of fibres ready for hardening and felting; but, from various causes, these attempts have hitherto failed. The object of the present improvements is to render this mode of procedure successful.

In the machinery for forming the bat, or as it is termed, "setting up the body," the fur or "stock," after it has been properly picked, is evenly spread upon an endless apron, which carries it to a pair of feed-rollers, between which it passes, and meets with a brush, revolving at a great velocity. This brush throws it along a tunnel; by means of which the fur, thrown by the brush, is directed on to the former. The tunnel is provided with an aperture immediately under the brush, through which a current of air enters, in consequence of the rotation of the brush. This rush of air along the tunnel, assisted as it is by the exhaustion of the perforated former,

has the effect of directing the fibres towards the former, on which they are deposited and held by the pressure of the atmosphere. As the fibres are only held on the former by the pressure of the surrounding air, caused by the exhaustion of the former, it is necessary, before the suspension of this pressure takes place, that some means should be adopted for retaining and consolidating the fibres of which the bat is composed; as it will be obvious, that a delicate web, thus produced, will not have sufficient tenacity to admit of its being removed from the former before the hardening process. This is effected by covering the bat (before it is removed from the cone or former) with felted cloth, and then employing two perforated metallic vessels; one to put over the bat after it has been surrounded with the moist cloth, for the purpose of pressing on the fibres, and yet allowing of the circulation of hot water, when the whole is immersed in a bath to harden the bat preparatory to felting; the other perforated vessel is to be placed within the perforated metallic former which received the bat (and which is necessarily thin and weak), for the purpose of resisting the pressure of the surrounding water, consequent upon a partial vacuum produced within the former when it is withdrawn from the water-bath.

The principal part of this invention consists in the employment of a tunnel of a peculiar construction, into which the fibres of fur are thrown by the rotating brush; which tunnel guides and directs the fur into an exhausted perforated former, placed in front of the delivery aperture thereof. The sides of this trunk or tunnel are constructed of thin sheet metal, or other substance which can be readily bent to the desired shape, so that the form of the aperture or mouth of the trunk which directs the fur or other material on to the perforated former, can be changed at pleasure, and thereby increase or decrease the deposit of fur on any part of the former, as it may be required to increase or decrease the thickness of any part of the bat. The top of the tunnel is so arranged that the end towards the former can be depressed or elevated at pleasure, for the purpose of adapting the mouth of the tunnel to any size of former. The top of the trunk is made to present an unbroken plane, and thereby the catching and retention of the fibres, or the formation of eddies in the current of air that passes through the trunk, is avoided. At the back of the tunnel, and below the feed-rollers and brush, a valve and shutter is provided, for the purpose of closing the aperture and preventing the passage of a strong current of air through the tunnel at the commencement of each operation, or until

the perforated former is covered with a film of fibres. By this means the formation of welts or air-bubbles in the bat is effectually prevented. At the commencement of the operation, when the deposit of fibres is just beginning to take place on the former, it will be obvious that the exhausting fan in the former will produce a much stronger current of air through the trunk than when the perforations are partly closed; and that, therefore, a tendency will be given to the fibres to fall unevenly, and with too great violence, on to the former, at the commencement of the operation. This, it is found by experience, produces counter currents, which throw up the first film of fibres from the surface of the former, and thus form welts or protuberances, which are very injurious to the bat. But, by closing the aperture at the back of the trunk, the fibres are, at first, deposited by a gentle current and pressure; and, after a film completely surrounds the former, the opening of the valve or shutter will admit the current, so that the fibres may be thrown on with more force to complete the bat. Below the feed-rollers, one, two, or more rollers, covered with cloth or like substance, are employed; the rotation of which, in connection with the brush, has the effect of brushing, combing, or otherwise straightening the fibres before they are thrown by the brush and carried to the former.

At figs. 1, and 2, *a*, represents a frame, of the usual or any desired construction; *b*, is an exhausting fan, with a chamber *c*; over which is placed the perforated former k^2, of any desired shape, and which is made of thin metal, perforated with fine holes and placed in front of the mouth or aperture *d*, of the tunnel or trunk *e*. This tunnel is carried back to, and is connected with, the case *f*, that surrounds the upper part of the rotary brush *g*; the bottom *h*, of the tunnel is flat, and gradually narrowed from the brush to the mouth; and to the edges of this are properly secured the sides *i*, *i*, of the tunnel, which are made of sheet-copper, sufficiently thin to admit of bending with facility, so that the mouth *d*, can receive any desired shape, and can, at any time, be changed, to regulate the deposit of the fibres on to the former *h*. By this means the attendant is enabled, by merely altering the shape of the mouth, to increase or decrease, to any desired extent, the deposit of the fibres on to any part of the former, and thus increase or decrease the strength of any desired part of the bat. The curve given to the sides at the mouth *d*, should be gradually run along the sides *i*, towards the back, until the curves are lost, so as to prevent any sudden curve along the sides. The top *k*, of this tunnel is made flat, like

the bottom, and fits within the sides; the back end rests on the top of the case *f*, of the fan; and the forward end, which is wedge-formed, extends a little beyond the sides. To the end, thus projecting, are attached bars *l*, *l*, which pass along on the outside of the metal sides *i*, *i*, and are connected again with the top at the back end; so that, the sides being thus embraced between the edges of the top and these bars, when the forward end of the top is depressed or elevated, the flexible or pliable sides follow; so that the upper part of the mouth of the trunk will always present the same size: the top is held at any desired elevation by means of a cord *m*, attached to any part of the frame. By this means the height, size, and form of the mouth may readily be adapted to any size or shape of former, or to the deposit of the fibres required on any part thereof. The back part of the tunnel, between the bottom and the lowest of the rollers behind the brush, is open for the admission of a current of air, which flows towards the exhausted former, induced by the exhaustion of the latter and the rotation of the brush. This aperture is provided with a regulating valve or shutter *n*, for the purpose of shutting off, in whole or in part, the current of air to the tunnel. The axle of this valve is provided with an arm or lever, to which a cord is attached, whereby the attendant can adjust the valve to any desired position, and thus regulate the force with which the fibres will be carried to the former.

The fibres are fed to the brush from an apron *q*, by the feed-rollers *r*, *r*, covered with cloth; and below these and in the curve of the brush are two other similar rollers *s*, *s*, also covered with cloth, against which the fibres are brushed by the rotation of the brushes: the surfaces of these rollers form a curved bed, against which the brush acts; whilst, at the same time, they continue to hold the fibres for the brush to act on them, after they have been liberated by the feed-rollers. One of the feed-rollers receives motion, by means of a belt, in the usual manner, and drives the others by means of gearing-wheels on one end of the rollers. Motion is communicated, from any first mover, to a main driving-shaft (not seen in the drawing), on which a pulley is mounted; from which a belt passes to a pulley on the shaft of the exhaust fan, whereby the required velocity is given to the fan for exhausting the perforated former. On the main driving-shaft there is a bevilled pinion in gear with a bevilled pinion on a shaft e^1, which carries, at its opposite end, a worm f^1. This worm f^1, works in and drives a worm-wheel g^1, on a vertical shaft h^1, the upper end of which carries, by means of arms i^1, a

grooved rim j^1, to which is fitted the lower edge of the perforated former. The said former should be properly fitted to the groove of the rim, so that it may be set in and removed readily, and yet, as near as possible, make an air-tight joint. The rotating fan and feed-rollers are driven by belts from pulleys on the main driving-shaft.

In operating the machine, the fur or other fibrous material, after being properly picked, is to be evenly spread upon the endless apron *q*, which gradually supplies it to the feed-rollers *r*, *r*. On passing between these rollers, it is presented to the rotating-brush *g*, which, after brushing the fur on the surface of the rollers *s*, *s*, throws it towards the delivery-aperture; the sides of the tunnel guide and direct the fur on to the surface of the perforated former, which, being exhausted, receives the fur on its surface, where it is held by the pressure of the atmosphere; and, as the former rotates slowly, the fibres are evenly deposited upon every part of its surface, until the required thickness has been obtained.

At the commencement of the operation, the valve or shutter *n*, in the aperture below the brush *g*, is closed, in order to check the force of the current that carries the fibres on to the former; and, when a film of fibres has been laid on the former, the valve must be gradually opened, so as to increase the current, and deposit the fibres with more force. If this precaution be not attended to, welts or protuberances will be formed in the bat, and thus render the bat defective.

So soon as the required thickness of bat has been obtained, it is to be surrounded with a moist felt or fulled cloth, for the purpose of retaining it on the former; and this must be done before the pressure of air is taken off. The best plan of effecting this object is to apply a piece of cloth, of suitable shape, to cover the top; and then to take a strip of cloth, rolled on a wooden roller, and apply it to the bat; so that, as the former rotates, the cloth will unwind from the roller and wind round the bat. The former is then taken from the machine, to submit the bat to the hardening process; and another one is put in its place.

A metal cap k^3, (shewn separately at fig. 4,) perforated with large holes, and made a little larger than the former, is put over the felt-covering; and a similar perforated metal case l^1, called a shield, and shewn detached at fig. 5, is inserted within the former; and then the whole, as shewn in section at fig. 3, is immersed in hot water, to harden the bat. The holes in the cap and shield admit the water freely to the bat; whilst, at the same time, the cap prevents the fibres of the bat from

being disturbed by the water; and the shield prevents the former from being collapsed when the whole is being drawn out of the water. After immersion in hot water, the bat will be sufficiently hardened to admit of its being removed from the former.

The patentee claims, Firstly,—the employment of the rotating-brush, in combination with the tunnel and an exhausted perforated former, placed in front of the delivery-aperture of the said tunnel. Secondly,—making the top of the tunnel, for directing the deposit of the fibres on to the exhausted former, adjustable; and constructing the sides thereof of thin sheet metal, or other suitable flexible material, which can be readily bent, and which will retain the form given to it,—so as to admit of changing the form and dimensions of the delivery-aperture of the tunnel, when it is desired to vary the thickness of the various parts of the bat to be produced. Thirdly,—the employment of the valve or shutter *n*, for the purpose of regulating the supply of air, which enters and passes along the tunnel, and directs the fibres on to the exhausted former, as described. And, Fourthly,—combining with the rotating-brush and feed-rollers, one, two, or more rollers, covered with cloth or other suitable substance, for the purpose of holding the fibres whilst being acted upon by the brush, as described. —[*Inrolled July,* 1850.]

To Abraham Moses Marbe, *of Birmingham, in the county of Warwick, chemist, for an improved manufacture of vegetable fluid, to be used in the production of artificial light,—and in lamps or burners for consuming the same; which vegetable fluid is also applicable to the manufacture of lacker or varnish.*—[Sealed 18th April, 1850.]

This improved manufacture of vegetable fluid, to be used in the production of artificial light, has for its object, firstly, to produce a combustible liquid, which shall be highly luminous when burned, and yet shall not produce dense smoke, as is now frequently the case when the combustible liquids, known as hydrocarbons, are burned in lamps for the purpose of illumination; and, secondly, to remove the liability of lamps becoming clogged up when the fluid is burned in the form of vapor, or to prevent the formation of a crust at the top of the wick, whereby the porosity and capillary action of the wick is impaired.

In the manufacture of the improved vegetable fluid, the

hydrocarbons known as wood-tar spirit, oil of turpentine, native naphtha (that is, naphtha flowing from the earth), naphtha commonly known as coal-tar naphtha, and naphtha obtained from bituminous substances, are employed. When wood-tar spirit, obtained by the distillation of wood-tar, is the hydrocarbon used, the following is the mode of proceeding:—Take one gallon of wood-tar spirit, and add thereto a pound of sulphuric acid diluted with a quart of water; mix these materials well together; and allow the mixture to remain from two to three hours to settle. The clear supernatant liquid is then carefully drawn off into a vessel containing clear water, in order to wash the greater part of the acid out of it; and the washed part is then further purified by being sprinkled upon ground or pulverized lime: the lime is placed on the bottom of a suitable vessel,—one quarter of a pound of lime being employed for each gallon of the liquid. To ensure the beneficial action of the lime, care must be taken that it is not made too wet at first. When all the liquid is added to the lime, the contents of the vessel must be well stirred, so as to mix the lime intimately with the liquor. The mixture is now allowed to rest until the lime has settled at the bottom of the vessel; and the clear liquor is drawn off into another vessel, ready to be used in the manner hereafter explained. Other alkaline substances will effect the desired object; but the use of lime is preferred.

In Plate II., fig. 1, shews the kind of vessel used for submitting the liquor to the action of the lime. The vessel is provided with several cocks, at different heights from the ground, in order to draw off the supernatant liquor.

The hydrocarbon, prepared and purified as above described, is mixed with a definite proportion of alcohol, or of pyroxylic spirit, sometimes called wood naphtha. Previous, however, to mixing these materials together, the alcohol, or pyroxylic spirit, is deprived of a certain amount of water which it contains, and which will prevent it from blending properly with the hydrocarbon when the two materials are brought together. For this purpose the patentee takes of the rectified spirit of wine or alcohol, or of pyroxylic spirit, one gallon and a half; of pulverized lime a quarter of a pound; and of calcined potash half a pound. The two solid matters he places in a tub or vat, and the alcohol or pyroxylic spirit he sprinkles thereon; a vapor will then arise; and when this has in some measure subsided, a further quantity of the alcohol, or of the pyroxylic spirit, must be sprinkled over it; taking care that the

lime is not at first made too wet, otherwise the action will be stopped. When all the spirit is added to the lime and potash, the ingredients are occasionally stirred, and then left for about one or two hours. To this one gallon of the hydrocarbon (purified in the manner above explained) is added, and the mixture is then distilled: the product of distillation will be a fluid capable of burning with a pure white light, without smoke, in the lamps hereinafter described.

When oil of turpentine is the hydrocarbon employed, the treatment for purifying it, and for the manufacture of the fluid, is the same as that already described in reference to the wood-tar spirit.

When naphtha is the hydrocarbon employed, sulphuric or nitric acid is used for its purification from foreign matters; taking in the proportion of sulphuric acid one pound, diluted with a quart of water; or of nitric acid half a pound, diluted with a quart of water. The process for drawing off the liquor, and purifying it from the acid, is the same as already described for the purification of wood-tar spirit. The naphtha, so purified, is to be mixed with the prepared alcohol or pyroxylic spirit, in the proportion of half a gallon of purified naphtha to one gallon and a half of prepared alcohol or pyroxylic spirit; and the mixture is to be distilled as before.

Other acids, as, for instance, the nitrous or the nitro-muriatic acid, will produce a similar effect on the hydrocarbons as the nitric or the sulphuric acid; but it is preferred to employ one of the latter. The patentee remarks that the fluid manufactured by the use of the sulphuric acid is colorless, and, by the use of the nitric acid, generally brown.

The hydrocarbons, prepared in the manner and by the processes above set forth, can be used as a substitute for camphine. The liquid obtained, in the manner and by the processes above described, is also applicable for the manufacture of lacker or varnish, in place of the alcohol or pyroxylic spirit usually employed for that purpose. The hydrocarbons, purified as above described, may be used together, as well as separately, in the manufacture of the fluid.

When it is desired to employ wood-tar spirit and naphtha, one quart of the purified naphtha and three quarts of the purified wood-tar spirit are mixed together; and to the mixture one gallon and a half of the prepared alcohol or pyroxylic spirit is added;—the treatment, already described, is then pursued. If oil of turpentine and naphtha are employed, one quart of the purified naphtha and three quarts of the purified oil of turpentine are mixed together; and to the mixture one

gallon and a half of the prepared alcohol or pyroxylic spirit is added; after which the treatment described is pursued.

In employing wood-tar spirit, oil of turpentine, and naphtha, the patentee takes one quart of the purified naphtha, one quart of the purified wood-tar spirit, and two quarts of the purified oil of turpentine, and, having mixed them together, and added one gallon and a half of the prepared alcohol or pyroxylic spirit, he treats and distils the mixture as before mentioned.

A fluid, highly combustible, and burning without smoke, in an ordinary spirit or camphine lamp, with a glass, may be manufactured by combining wood-tar spirit with oil of turpentine, purified as above described, without the addition of the prepared alcohol or pyroxylic spirit. Or the following plan may be pursued:—Take one gallon of oil of turpentine, and add thereto two fluid ounces of nitro-muriate of tin; well stir the mixture, and allow it to settle; then draw off the clear oil of turpentine, and wash it with water. For the purpose of neutralizing the acid, sprinkle it on ground or powdered lime or potash; and, when the mixture has been distilled, a pure inflammable fluid will be obtained.

The hydrocarbon wood-tar spirit may be treated with nitro-muriate of tin, in the same manner as lastly above described for oil of turpentine, and a fluid obtained therefrom by distillation: the fluid so obtained does not burn with so bright or pure a flame, but it may be mixed with an equal quantity of the purified oil of turpentine, lastly described, when it will give a bright flame.

The oil of turpentine or wood-tar spirit, purified by the use of nitro-muriate of tin, as first described, may be mixed with the prepared alcohol or pyroxylic spirit; when a very pure and highly combustible fluid will be obtained from the mixture by distillation.

The oil of turpentine or wood-tar spirit, purified by the nitro-muriate of tin, may also be mixed with purified naphtha, and burnt without alcohol.

A highly combustible fluid is also manufactured from wood-tar spirit and oil of turpentine, by treating each with nitrate of iron. For this purpose half a pound of nitrate of iron, diluted with a quart of water, is gradually poured into one gallon of oil of spirit of tar, or into one gallon of oil of turpentine,—the mixture being stirred now and then for three or four hours; it is then allowed to settle, and is strained off from the acid, and sprinkled on to lime, and distilled by itself: the clear liquor, when separated from the water carried over by

distillation, will be fit for burning, without alcohol or pyroxylic spirit, in a common spirit or camphine lamp, with a glass. Instead of treating the wood-tar spirit and oil of turpentine separately, they may be mixed together, and the mixture treated as lastly above described, when the substances are taken separately.

A fluid, highly combustible, may also be produced by the use of a portion of the naphtha, purified as firstly above described. For this purpose one quart of the purified naphtha and three quarts either of the purified oil of turpentine or of the purified wood-tar spirit, are mixed together: the mixtures will be a liquid, which will burn with a clear white light in an ordinary spirit-lamp,—burning either by a wick or as vapour.

A like fluid may also be produced by using the oil of turpentine or spirit of wood-tar (treated with the nitrate of iron or nitrate of copper, run through lime, and distilled) by adding to each gallon of oil of turpentine, or to each gallon of wood spirit of tar, one and a half gallons of alcohol or pyroxylic spirit, treated as already described: this fluid is said to burn without smoke, and without a glass, in the lamps hereinafter described.

The patentee observes, that the relative proportions of the different hydrocarbons and spirits, above specified, are those which have, in practice, been found most applicable; but, inasmuch as the composition of the several hydrocarbons is liable to certain limited variations, and they are sometimes more or less dense, it becomes necessary, in such case, to modify the proportion of the alcohol, or of the pyroxylic spirit, so as to give to the mixture the desired quality.

The patentee next proceeds to describe his improved manufacture of lamps and burners, for consuming such of the combustible liquids, above described, as are produced by distilling the hydrocarbons, alcohol, or pyroxylic spirit, in combination. The lamps and burners are shewn, in several views, in Plate II. Fig. 2, represents a wall or bracket-lamp, constructed according to the present invention,—the burner part of the lamp being drawn in section, in order to shew more clearly the interior construction. The burner consists of a long brass or other metal tube *a*, for containing the wick; and on the upper end of this tube is screwed, or otherwise fastened, a cover *b*, which is pierced all round with horizontal holes, and is furnished with a button at top, for the purpose of directing the flame outwards, as shewn in the drawing. The lower end of the tube *a*, is screwed into the top of a

small chamber or reservoir *c*, at the upper end of the supply-pipe, which is furnished with a cock for cutting off the supply of liquid when required.

The wick *d*, consists of some ordinary cotton wick, wound round the forked end of a wire *e*, as shewn in figs. 3. The wick, wound lightly round the wire, is pushed into the wick-tube *a*, nearly up to the top; but the lower end is allowed to project below the tube *a*, and dip into the liquid in the reservoir or chamber *c*. The holes in the upper part of the burner must be extremely small, say pin-holes, otherwise the liquid will consume too rapidly; also the cotton or wicking must fit loosely in the tube, so as to admit of the free passage of the liquor; and the reservoir at the bottom of the tube, into which the wick enters, must be of sufficient dimensions to keep the wick well supplied with the liquid.

Fig. 4, represents a similar construction of burner, adapted for a table-lamp. In this case the chamber *c*, is dispensed with, as the lower end of the wick is immersed in the liquid contained in the large glass reservoir. This lamp is lighted by means of the instrument shewn in plan and edge views at figs. 5. This instrument consists of a wire handle, at the end of which is a forked piece of wire gauze of several thicknesses. By dipping this instrument into some inflammable liquid, enough of the latter will adhere to the gauze to burn for a short time; the forked end, in an ignited state, must then be placed against the upper end of the tube *a*, (as shewn by dots in fig. 4,) and held there sufficiently long to vaporize a portion of the liquid with which the wick is saturated: the gas or vapor, thus generated, will then issue from the holes at top, and will be ignited by the flame. A small cup *f*, which surrounds the tube *a*, serves to receive any drippings that may fall from the forked end of the igniting instrument, and will prevent it from running down and soiling the lamp. Between the burner and reservoir may be placed a box, filled with charcoal or other medium not readily conducting heat.

Fig. 6, is a side elevation of another form of burner, adapted to a ship's lamp. The body of the lamp is mounted on gimbles; and the wicks are composed of threads of cotton, inserted in tubes *a, a, a*: these tubes are made larger at bottom than at top; and the wicks being made to project beyond the top of the tubes, may be ignited and made to burn, as shewn in the figure. *g, g*, are small caps or extinguishers, which are suspended from the edge of the burner.

Fig. 7, is a side view of a small glass lamp, suitable for a binnacle-lamp, being mounted in gimbles, as at fig. 6. In

this instance, however, there is only one wick-tube *a*; but there is a glass reflector *h*, which throws the light downwards.

Fig. 8, is a view of another lamp, in which only one wick-tube is employed. It is intended to represent a small hand or portable lamp. The wick is inserted in a wick-tube *a*, as before; but this tube is surrounded by a second tube *i*, which is adjustable, and may be moved up and down, in order to regulate the size of the flame. To the lower end of the tube *i*, is attached a spring *j*, which passes through a hole in the flat plate *k*, and retains the tube *i*, at any altitude; or the spring *j*, may be dispensed with,—the tube *i*, being kept in its place by the wick alone: the cap or extinguisher is attached to the lamp by a chain.

Fig. 9, represents a single-wick burner, adapted to a carriage-lamp. It is well known that in carriage-lamps, when candles are used, the candles are pressed upwards by a spring, placed in the circular socket of the lamp: the candle and its spring are dispensed with in this instance, and, in lieu thereof, a small cylindrical chamber *l*, is employed, for containing the inflammable liquid. The lower end of the wick dips into the liquid in the chamber, and the upper end passes through a short tube above. The cylindrical chamber or vessel *l*, is held steadily in its place, and prevented from shaking about, by means of the springs *j*, *j*.

Fig. 10, represents, in sectional view, another construction of burner, in which a crescent or half-moon-shaped flame is produced;—the wick-tube *a*, is similar to that shewn at fig. 2; but the cap-piece *b*, which forms the burner, is of a crescent shape, having holes formed in the upper part, and furnished with division pieces *m*, *m*, between the holes, for the purpose of preventing the flame from the different jets from joining.

At fig. 11, is shewn another form of burner, in which the jets consist of two horizontal holes at the side of the cap-piece, and one vertical hole in the centre;—the burner is also furnished with two wing-pieces or spreaders, as shewn in the drawings.

Figs. 12, represent plan and vertical sectional views of another form of burner. In this instance the cap-piece is perforated at top with several holes, whereby the flame is separated and kept apart.

Figs. 13, represent similar views of another burner, constructed somewhat upon the principle of an ordinary argand gas-burner. It is perforated with a series of holes at top, and is furnished with a button or deflector *b*.

Fig. 14, shews another form of argand burner, adapted to

a table lamp. In this instance the tube *a*, is screwed on the outside, and carries the gallery *n*, which supports the glass chimney *o*, *o*. It will be seen that, by screwing the tube *a*, the gallery, and consequently the glass chimney, may be rendered adjustable, and the light thereby regulated; as the gallery and glass may be raised or lowered by merely turning the gallery on the tube *a*. This tube passes through a box or chamber at *p*, filled with pulverized charcoal or other bad conductor of heat. It will be seen, that the glass chimney is of a peculiar form, so that, as it is raised or lowered, the light or flame may be regulated by the quantity and direction of the current of air that is admitted to the exterior of the flame.

Figs. 15, represent views of a glass shade and deflector. By causing the shade to rest on the upper part of the deflector (which, being made of glass, will not prevent the light from passing through), the two articles together are made to answer the purpose of a chimney, globe, and reflector; they may, however, be used separately, or for different lamps.

Fig. 16, is a side elevation of a lamp, with a pair of burners and reflectors. The burners are similar in construction to some of those already described; they are screwed into, or otherwise attached to, branch pipes, which diverge from a reservoir A, mounted on an upright bar D, on which it works; so that the reservoir, and consequently the lamps, may be raised or lowered on the bar D, and retained at any required altitude by tightening the screw *q*.

Fig. 17, is a portable stable or miner's lamp or lantern, constructed to burn the improved liquid. The burner is made upon the principle shewn in figs. 7, and 9. The lamp E, is moveable, and is made of glass, and, when required for use, is placed in the socket F, at the lower part of the lantern. The upper part of the lantern is made of thick glass, and in a conical form, and is connected to the lower part of the lantern by means of a bayonet-joint.

Fig. 18, represents another form of lantern. In this instance the reservoir of the lamp is not removable, but forms the bottom part of the lantern,—the only removable part of the whole lantern being the glass, which is supported on a gallery *r*, and may be taken off the lamp by lifting it up vertically.

In the lamps and burners constructed for the purpose of burning the vegetable fluid manufactured according to this invention, the wick is to be lightly wound, and inserted loosely in the tube; for if the wick be tightly wound, or be tight in

the tube, as in spirit and vapour lamps in ordinary use, the fluid will not pass freely through the cotton, and the cotton will singe.

The patentee remarks, that the lamps above described are intended to burn the fluid manufactured from the combination of the purified hydrocarbons and prepared alcohol or pyroxylic spirit, and not the fluid manufactured from the hydrocarbons without the prepared alcohol and pyroxylic spirit.

He claims, First,—the manufacture of a fluid, suitable for illumination, from hydrocarbons, alcohol, and pyroxylic spirit, purified and treated with acids, lime, and alkaline substances, and distilled together, as above described. Secondly,—the manufacture of a fluid, suitable for illumination, from hydrocarbons, purified and treated with acids, lime, and alkaline substances, as above described. Thirdly,—the manufacture of a fluid, suitable for illumination, from hydrocarbons, purified and treated with nitro-muriate of tin, as above described. Fourthly,—the manufacture of a fluid, suitable for illumination, from hydrocarbons, purified and treated with nitrate of iron, as above described. Fifthly,—the manufacture of a fluid, suitable for illumination, from hydrocarbons, treated and purified with nitro-muriate of tin, or nitrate of iron, either alone or in combination with naphtha, or with oil of turpentine, or with wood-tar spirit, or with alcohol, or with pyroxylic spirit, as above described. Sixthly,—the manufacture of lacker or varnish by the use of the combustible fluids manufactured, as above described. And, Lastly,—the adaptation of lamps and burners, constructed as shewn in the drawings, to the burning of the fluid manufactured from the purified hydrocarbons and prepared alcohol and pyroxylic spirit, distilled in combination, as above described.—[*Inrolled October,* 1850.]

To Albert Crakell Waterlow, *of London Wall, lithographer, for improvements in the means and apparatus for obtaining copies of writings, drawings, and other designs,—being a communication.* — [Sealed 3rd January, 1850.]

This invention consists in certain methods of arranging apparatus for obtaining copies of writings, such as letters and other documents, and impressions from stones or plates of drawings or other designs, in like manner to that by which lithographic drawings and designs are produced.

In Plate III., fig. 1, is a sectional elevation, and fig. 2, is a plan view of a machine, arranged according to one part of this invention. *a*, is the bed-plate of the machine, along each side of which there is a groove or recess *b*, to receive the lower end of the standards *c*; and these standards are furnished with small rollers *d*, which travel beneath the projecting upper edges of the grooves *b*. The standards *c*, are connected together at the top by a tie-bar (indicated by the dotted lines *e*, in fig. 1, but not shewn in fig. 2,); and they carry the pressing-cylinder *f*. When this apparatus is used to obtain copies of letters or other documents, the paper to be copied is placed on a piece of felt upon the table *g*, (the felt, may, however, be dispensed with); upon this paper is laid the damp paper, which is to receive the impression, and over it a piece of felt is placed; the frame or carriage *c*, is then drawn backwards and forwards by hand. The pressing-cylinder *f*, in passing over the table *g*, causes the damp paper to receive the impression: the degree of pressure required for this purpose is obtained by means of the regulating screws *h*, which act upon the bearings of the cylinder *f*;—springs being interposed between the screws and the bearings, to admit of the cylinder yielding slightly when passing over the papers. When the machine is used to obtain copies from a stone or a plate, the stone or plate is placed in the position of the table *g*; and the ink is applied thereto, and the operation conducted in the manner well understood by persons employed in the various departments of lithography and zincography. In some cases, instead of using the pressing-cylinder *f*, the patentee uses a bar, with a rounded under edge, which is acted upon by levers and springs, so as to vary the pressure when required.

Fig. 3, is a longitudinal section of a modification of the above machine. In this instance the bed *a*, on which the stone *g*, is fixed, is not stationary, but moves upon the rollers *d*, between the two cylinders *f*, *i*, which turn in bearings, carried by the metal framework *j*,—suitable screws *h*, being applied to the bearings of either the upper or the lower cylinder, for the purpose of regulating the pressure. Upon each side of the bed is fixed a rack *k*, gearing into a pinion, fixed on the axis of the cylinder *i*; so that when the handle *l*, on the end of the axis, is moved up and down, the axis will be caused to perform part of a revolution in either direction, and, by means of the pinions, to move the bed *a*, and stone *g*, to and fro beneath the cylinder *f*. The patentee states that, "instead of a rack and pinion, a spring, placed upon the table, and acting upon friction-rollers, would press the

table or bed upon the lower cylinder, in order to its receiving motion from it; but these are not absolutely necessary to produce the requisite pressure."

Fig. 4, is a plan view, and fig. 5, an edge view of a simple apparatus for obtaining copies according to the lithographic or zincographic process. It consists of a stone, or a plate, or a suitable bed to support autographic paper, on which writing is produced in the manner well understood by persons engaged in the lithographic and zincographic processes; on this the paper to be printed is placed, and is covered with a sheet or tympan *a*, of any suitable material, which is fixed, by pins or otherwise, to the stone or plate; and then pressure is applied, by drawing the piece of wood *b*, (fig. 6,) or a roller, over the sheet *a*, and a copy of the writing is thereby obtained. This apparatus may be used for taking copies of letters on damped paper. It may, with the inking-roller and the various materials required in the process of printing, be arranged in a box, so as to be easily carried from one place to another; and it may be readily used on a table or other convenient place, without being permanently fixed.

In conclusion, the patentee states that he does not confine himself to the various modes of working the apparatus, nor to the mode of communicating the pressure, so long as the peculiar character of the various parts of the invention be retained.—[*Inrolled July*, 1850.]

To William Cox, *of the firm of William Cox & Co., of Manchester, cigar merchant, for certain improvements in machinery or apparatus for manufacturing aerated waters or other such liquids.*—[Sealed 11th June, 1850.]

This invention consists, firstly, in an improved arrangement of apparatus for manufacturing aerated liquids, by means of which the impregnating gas may be sustained at a pressure sufficient to cause its amalgamation with the water or other liquid to be aerated, without the aid of force-pumps or other mechanical means of producing the required pressure; secondly, the invention consists in an improved construction of tap or cock, to be employed with the above-mentioned apparatus or other apparatus of a similar nature.

In Plate III., fig. 1, is a plan view, and fig. 2, a longitudinal section of the apparatus. *a*, is a vessel, termed the gas generator, wherein the gas is generated; *b*, is the vessel in which it is purified; and *c*, is the vessel that contains the acid to be used for producing the gas: the vessels *a*, *b*, are made of cop-

per, tinned on the inside; and the vessel *c*, is also made of copper, but is provided with a lining of lead. The vessel *c*, is fixed on the top of the generator *a*, and communicates therewith by means of the pipes *d*, and *e*. The pipe *d*, is for the purpose of introducing the acid into the generator; and the upper orifice thereof is closed by the conical end of a plug *f*, which is covered with lead, and is furnished at the top with a short male screw, taking into a female screw formed in the neck of the vessel *c*; so that when the plug is turned, by means of the handle *g*, it will rise and permit the acid to descend through the pipe *d*, into the generator. A communication is established between the upper part of the vessel *a*, and the upper part of the vessel *c*, by means of the pipe *e*, in order to equalize the pressure of the gas above and below the acid, when the plug *f*, is raised, and thereby to permit the acid to descend into the vessel *a*. The gas generator *a*, contains an agitator *h*, which is caused to rotate by means of the handle *i*; the generator is connected with the purifier by a pipe *j*, which is furnished with one of the improved taps, and descends to the lower part of the vessel *b*; and this vessel is connected with a pressure-gauge by a pipe *k*, also provided with an improved tap. The gas generator has an opening 1, for the introduction of lime and water; a cock 2, through which the air is permitted to escape therefrom; and an opening 3, for discharging its contents. The purifier *b*, has an opening 5, for admitting water into it; a cock 6, which is at first used for the escape of air, and is afterwards connected by a tube with the vessel containing the liquid to be aerated; and an opening 7, for discharging the water. The vessel *c*, is provided with an opening 4, through which the acid is introduced into it.

The mode of using the apparatus is as follows:—Suppose the generator *a*, to be charged with about four gallons of water and about two gallons of chalk, lime, or other suitable alkaline substance; the purifier to be half full of water; the vessel *c*, to contain about one gallon of sulphuric, hydrochloric, or other suitable acid; and all the taps and openings to be closed. The plug *f*, is raised, by turning the handle *g*, so as to admit a sufficient quantity of acid into the vessel *a*, to disengage the carbonic acid gas; and the alkali and water are at the same time kept in a state of agitation by means of the agitator *h*. The gas, which is evolved during the neutralization of the acid by the alkali, will compress the atmospheric air into the upper part of the vessel *a*; and the tap 2, being then opened, the air will escape, leaving the vessel filled with gas. The tap 2, is then closed, and the taps on the pipes *j*,

and *k*, are opened. The gas will then flow into the purifier *b*, and, passing through the water therein, will be purified. The atmospheric air, which is compressed into the upper part of the purifier by the pressure of the gas, is allowed to escape by opening the tap 6; and then this tap is closed and is connected with a pipe which enters the cylinder or receiver containing the liquid to be aerated,—such pipe extending to within two or three inches of the bottom of the receiver. When the gas has arrived at the desired pressure (which may be ascertained by inspecting the pressure-gauge connected with the pipe *k*,) the tap 6, is to be again opened, so as to permit the gas to pass into the receiver, the liquid in which is to be kept agitated, to facilitate the impregnation of the same with the gas. The patentee states that, supposing the receiver to contain eighteen gallons of water, the above described apparatus, with the proportions of acid, alkali, and water, before mentioned, will be sufficient to charge the water with gas in excess under a pressure of from three to four hundred pounds per square inch in from fifteen to twenty minutes.

Fig. 3, is a vertical section and fig. 4, an external elevation of the improved tap, the construction of which will be readily understood on examining these figures. *l*, is the handle by which the central piece *m*, is moved round in order to open or close the tap.

The patentee claims, First,—the construction and arrangement of apparatus shewn and above described, or any similar contrivance whereby the impregnating gas may be sustained at a pressure sufficient to cause its amalgamation with the water or other liquid to be aerated, without the aid of force-pumps or other mechanical means of pressure,—without being confined to the dimensions of the apparatus, as shewn in the drawing, or any suitable modification in the arrangement thereof, or to the materials of which the same may be made or composed. Secondly,—the peculiar form or construction of tap shewn in the drawing, as adapted to such or similar apparatus.—[*Inrolled December*, 1850.]

To John Turner, *of Birmingham, engineer, and* Joseph Hardwick, *of the same place, for a certain improvement or certain improvements in the construction and setting of steam-boilers.*—[Sealed 15th April, 1850.]

The improvements in the construction and setting of steam-boilers, which constitute this invention, are represented in

Plate II.; where fig. 1, represents a longitudinal vertical section, fig. 2, a horizontal section, and fig. 3, a transverse section of a steam-boiler. *a*, is the boiler, which is formed with a central flue *b*, extending from one end to the other. The front part of the flue contains the fire-bars *c*, and a brick fire-bridge *d*; and the flue is contracted at the part b^1, behind the fire-bridge, and directly beneath the man-hole *e*,—the object being, to obtain more room for the entrance of a man into the boiler, in order to clean the same. From the central flue *b*, the products of combustion pass into the end flue *f*, thence along the side flue *g*, through the transverse flues *h*, *i*, in the front end of the boiler, into the side flue *j*, which communicates with the chimney. The flues *h*, and *i*, are made of an arched form, so that any matters which may be deposited therein, by the current of smoke and gases, will fall into the side flues. The boiler is set with a space *k*, beneath it; and this is closed by a thin brick wall, which can be readily broken through when it is desired to get at the bottom of the boiler.

The patentees claim, as their invention, the construction of steam-boilers, in which the current of heated air is made to cross the anterior portion of the boiler through one or more flues; and also the contraction of the fire-place immediately under the man-hole, so as to give greater room for the entrance of a man, for the purpose of cleaning the said boiler. They also claim the particular method of setting steam-boilers, above described and represented in the accompanying drawing.—[*Inrolled October*, 1850.]

To William Henry Ritchie, *of Brixton, in the county of Surrey, Gent., for improvements in the manufacture of copper, brass, and other tubes or pipes,—being a communication.*—[Sealed 23rd April, 1850.]

This invention consists in a method of rolling cast tubes or pipes, composed of copper, brass, or other suitable metal, whereby they may be elongated, or drawn to various shapes. The tubes are subjected to pressure between a pair of rollers, having taper grooves; and these rollers are caused to rotate alternately in opposite directions, so as to take in the tubes, and deliver them at the same side of the rollers.

In Plate II., fig. 1, represents, in vertical section, a pair of grooved rollers, of the kind used by the inventor. The same surface-speed is given to these rollers by gearing them together; and they are caused to rotate alternately in opposite

directions, as shewn by the arrows, so as to take in a cast tube (a mandril being first inserted therein), and press it between the grooved surfaces; and then, by the reverse motion, carry it back, and release it from their pressure. The return motion of the rollers is continued somewhat longer than the advancing motion, agreeably to the amount of elongation that the tube is supposed to have undergone; and so on for each successive rolling. After the first rolling operation has been effected, the tube is again submitted to the rollers, and its length is still further extended; and the return motion being again somewhat increased beyond the take-in motion, the tube will, at every successive take in, be moved forward into a narrower portion of the grooves, and thereby become reduced in its diameter. The tube, thus gradually submitted to a reduced diameter of the grooves, will ultimately assume a conical form, corresponding to the shape of that portion of the grooves by which the pressure has been given to the tube. If, however, the operation is continued, the tube will gradually assume a cylindrical form from the smaller or forward end backwards; the tube being made to protrude through the smallest diameter of the grooves, and eventually to free itself of their pressure. The patentee remarks, that after each backward movement of the pressing-rollers the tube should be slightly turned, so as to cause the principal bite of the rollers to act on different parts of the surface of the tube. It will also be found necessary to withdraw the tube occasionally from its mandril during the progress of the rolling operation, and to subject it to the annealing process. If thought desirable, the rollers may be furnished with grooves of different sizes, so that the tube may be passed through them in succession; or more than one tube may be operated upon at the same time. The tubes to be operated upon are preferred to be cast conical, but this is not essential.

By this process it is stated that not only is a new mode of making cylindrical tubes or pipes obtained, but new forms may also be made, as shewn at figs. 2, 3, and 4. Fig. 2, it will be seen, tapers from the middle towards its ends; fig. 3, shews a tube with an enlargement at its middle, but having a cylindrical bore; and fig. 4, shews a similar tube, with an enlargement at one end. These new forms of tubes result from the operator being enabled to submit first one end and then the other to the action of the rollers.

The patentee claims, First,—the mode, herein described, of elongating cast copper, brass, and other suitable metal tubes or pipes, by rolling surfaces caused to alternate in their rotations, and to act as above explained. And, Secondly,—

the making of pipes or tubes, without seams, of the forms described, in reference to figs. 2, 3, and 4.—[*Inrolled October,* 1850.]

To RICHARD ARCHIBALD BROOMAN, *of Fleet-street, London, for improvements in the manufacture of zinc, and in the apparatus employed therein,—being a communication.*— [Sealed 20th April, 1850.]

THIS invention consists in certain methods of and apparatus for reducing zinc direct from ores containing the same, without resorting to the preparatory processes of assorting, pounding, and crushing.

In Plate III., fig. 1, is a vertical section of the furnace which the patentee employs in carrying out the invention; and fig. 2, is a transverse section thereof, taken on the line 1, 2, of fig. 1. *a,* is the hearth of the furnace; *b, b,* are the tuyeres, three in number; *c,* is the "shoot;" and *d,* is the chamber, which is contracted at *e,*—so that the charge, as it falls from the upper part d^1, of the furnace, will leave an annular space at *f,* between it and the sides, where the volatilizable matters may collect. From this annular space four inclined rectangular passages *g,* formed of cast or sheet-iron, lead off at right angles; the outer part of each passage is enclosed in a chamber *h,* through which cold water circulates (entering through the pipe *i,* and flowing off through the pipe *j,*); to the lower end a pipe g^1, is attached, in order to carry off the uncondensed gases; and the bottom of each passage is furnished witb a slide or door g^2. The upper part of the furnace is closed by a cover *k.* The interior parts of the furnace are made of fire-brick, with an outer casing *l,* of ordinary brick,—a space l^1, being left between the two, and filled with some substance that is a bad conductor of heat. *m, m,* are strengthening plates of cast-iron, which are inserted in the brickwork over the tuyere openings. *n, n,* are cast-iron frames, which support the passages *g,* and chambers *h.*

After the furnace has been built it is left to dry; and then a fire is kindled on the hearth and kept up for three weeks by the introduction of coke or other fuel through the throat. At the end of this time a small charge of quick-lime is thrown into the furnace; and as soon as this charge has descended as far as the tuyeres, a mixture of ore, flux, and fuel is thrown in, the top of the furnace is closed, and a moderate blast of air is applied by means of tuyeres. The fuel, flux, and ore should be used in such relative proportions that the whole of the zinc in the ore may be reduced and then volatilized, while

all the foreign matters shall form with the flux a slag of more or less fluidity when in the heated state. The fuel used may be coke, charcoal, common coal, anthracite, or turf; the quantity used should be greater at the commencement than during the subsequent stages; and it should always be sufficient, not only to completely reduce the zinc, but also to leave such an excess that, when it arrives at the tuyeres, the combustion thereof will not give rise to any gaseous oxidating product—such as carbonic acid. The flux must be employed in such a state as not to produce any oxidating matter during the formation of the slag; therefore when lime is used as a flux, it should be in a caustic state; and for the same reason a blast of air deprived of aqueous vapor, or perfectly dry, should be employed. The products of the furnace are the gases produced by the combustion of the fuel, the vapors of zinc, and the non-volatilizable matters, consisting of slag and of reduced metallic substances of greater density than the zinc. The gases produced by the combustion of the fuel pass off through the pipes g^1, and may be used for heating the boiler of the steam-engine that drives the blowing-machine or burning the lime which is to be used as a flux, or drying and roasting the ores, or for melting the zinc which is carried over in a state of vapor. The vapors of zinc are condensed in the passages g; and, after being removed therefrom by a rake, they are reduced and formed into ingots or bars. The residual matters, which collect on the hearth of the furnace, are run off from time to time.

When the zinc ores are in the state of oxide (either free or combined with carbonic or silicic acid), they are first dried, and if they contain a carbonate, they are roasted: the flux used for these ores is quick-lime. If the ores contain other metals beside zinc (such as lead or iron), these are reduced to the metallic state and collect on the sole of the furnace in different strata, according to their respective densities, and may be drawn off separately. When the ores are of the class containing sulphuret of zinc or blende, they are either brought, by roasting, into the state of oxide, and then mixed with a little damp clay and formed into blocks, which, after being dried, are treated as above described; or else they are mixed with a quantity of iron ore, so that, when the metals are fused, the iron shall combine with the sulphur and set the zinc free: in the latter case, quick-lime is used as the flux; and if the ore contains baryta or gypsum, fluorine [*qy.* fluor spar] is added. The iron ore most suitable to be used is that which contains zinc, but not in sufficient qnantity to be treated separately as a zinc ore. When the iron ore contains water or

carbonic acid, the same must be expelled by roasting, in order that no substance capable of oxidizing the zinc may be introduced into the furnace; and if it contains too great a quantity of oxidating matter, it is preferable to separate the sulphur from the zinc ore by the use of cast or malleable iron: in either case, the quantity of iron ore or iron required, will depend upon the amount of sulphur contained in the zinc ore (as ascertained by assaying it);—the iron ore or iron being used slightly in excess of the quantity absolutely required for combining with the sulphur.

When a sulphuret of zinc containing several other metals, such as lead, iron, copper, silver, &c., is treated in the furnace, there collects on the sole or hearth, besides the slag, a stratum of argentiferous lead; above which there is a stratum of cast-iron, arising from the excess of iron ore or iron used in the process; and above the iron there is a mass composed principally of sulphuret of iron, sulphuret of copper, and portions of the sulphurets of other metals. In this case the metal should be run off more frequently than in the preceding cases. The lead, thus obtained, may be cast into pigs ready for sale; or, if it should contain silver, it may be submitted to the process of cupellation. The mass of crude metal may be treated according to any of the well-known processes in order to extract the copper therefrom.

If white, grey, or yellowish oxide of zinc should be formed accidentally in the passages *g*, it can be used at once as a coloring matter; or it may be mixed with damp clay, made into blocks, dried, and again passed through the furnace: in this case a sufficient quantity of quick-lime should be added to convert all the clay into a fusible slag.

In conclusion, the patentee states that the distinguishing features of the improved apparatus and processes, which constitute this invention, are as follows:—First, the direct reduction of the ores of zinc by means of a smelting furnace and blowing apparatus, without any previous assorting, pounding, or crushing. Secondly, the employment of a smelting furnace for this purpose of the peculiar description represented and above explained: that is to say, a furnace having a narrow neck or passage, by the descent through which of the charge an annular space is formed around it in the top or crown of the furnace, where the vapors of zinc collect, but are prevented by the heat from condensing; having also passages of a rectilineal form through which the vapors of zinc pass off to be condensed (a form which permits the rake to traverse and completely clear the passages from end to end); and further

provided with condensing chambers, through which a current of cold water is kept continually flowing, in order to aid the process of condensation. Thirdly, avoiding the introduction into the furnace of any substance capable of re-oxidizing the zinc produced: which is effected by the drying and roasting of the hydrated and carbonated ores of zinc and iron; by the drying (in certain cases) by means of hot blast; and by the use of cast or malleable iron for the purpose of combining with and extracting the sulphur contained in sulphuretted zinc ores. Fourthly, the direct treatment of blende which has not been roasted, and the reduction thereof by means of the iron employed: that is, either the cast or malleable iron, or the iron produced by the ore, which becomes converted into cast iron or sulphuret of iron in the furnace itself. Fifthly, the peculiar method of treating sulphuretted or arseniuretted ores of lead and copper containing zinc, whereby the zinc is separated from the other metals and obtained in a metallic state. Sixthly, the method of turning the zinc contained in ores of iron to good account, without injuring the latter metal.

The patentee claims, First,—the direct reduction of zinc from its ores by means of the apparatus and processes (all or any of them) above described. Secondly,—the peculiar construction of smelting furnace above described.—[*Inrolled October*, 1850.]

To Charles Greenway, *of Green-street, Grovenor-square, in the county of Middlesex, for improvements in ships' and other pumps; in anchors; and in propelling vessels.** [Sealed 19th June, 1850.]

This invention consists, first, in improvements in valves for ships and other pumps; and, secondly, in improvements in manufacturing anchors.

The improved construction of valve is represented in Plate III., at figs. 1, 2, 3, 4, 5, and 6. Fig. 1, is a plan view, and fig. 2, a vertical section of the valve. *a*, is the perforated seat of the valve, shewn separate in plan view at fig. 3, and in section at fig. 4; it supports the perforated piece *b*, which is also shewn detached at figs. 5, and 6; and the surfaces of the two parts *a*, *b*, which come in contact, are ground, so as to fit accurately. The piece *b*, has a tubular stem b^1, which

* By a disclaimer and memorandum of amendment, dated December 19, 1850, the patentee has struck out the words "and in propelling" from the title of his patent, and inserted the word "and" after "pumps;" so that the title now reads, "improvements in ships' and other pumps, and in anchors."

descends through the circular part a^1, of the seat, and thus serves to guide the piece *b*, in its movements; and the extent of motion of the piece *b*, is regulated by the nut *c*, on the lower end of the stem, coming in contact with the under side of the part a^1. The upper part of the valve consists of a disc *d*, ground at its edge to fit tight over the perforated part of the piece *b*, and having a solid stem *e*, which descends through the tubular stem b^1, and receives a nut *f*, at the bottom, by which the extent of motion of the disc *d*, is limited. When the valve is acted on by the pressure of water or other fluid, the pieces *b*, and *d*, rise from their respective seats, and thus present two passages for the escape of the fluid. Although the patentee has only shewn two moving pieces, he does not confine himself thereto: thus the valve might consist of three moving pieces; and, in that case, there would be three passages for the escape of water or other fluid.

The improved mode of manufacturing anchors consists in stamping the form of an anchor out of sheet metal, placing a number of such forms side by side, so as to obtain the thickness desired, and then securing the whole together, instead of adopting the usual mode of forging anchors out of solid bars of iron. Fig. 7, is a side view and fig. 8, an edge view of an anchor made of five forms or pieces of sheet iron (but the patentee does not restrict himself to this number), which, if the anchor is intended to be what is termed a portable one, are secured together by screw-bolts and nuts; so that when the anchor is not required for use, the pieces may be separated for convenience of stowage or transport; but if the anchor is to be a solid one, the several pieces are welded together by forging or by pressure, at a suitable heat, between dies acted on by a steam hammer. In the portable anchors, the patentee prefers to insert a form of sheet zinc between the several forms of sheet iron, to prevent corrosion. In order to form the flukes, the ends of the forms of sheet iron are made as shewn at figs. 9, where *a*, indicates the centre-piece, *b*, the shape of two adjacent ones, and *c*, the shape of the two outer ones: the pieces *b*, and *c*, are stamped out of the sheet metal as represented by the dotted lines, and then those parts are turned over to form the flukes. If preferred, however, the flukes may be made separately and rivetted or otherwise attached to the anchor.

The patentee claims, First,—the mode, above described, of constructing ships' and other pumps. Secondly,—the mode, above described, of constructing anchors.—[*Inrolled December*, 1850.]

Scientific Notices.

Patentable Invention and Scientific Evidence, with an Introductory Preface. By WILLIAM SPENCE.*

NOT the least striking feature of the present times is the general desire which exists for the perfecting of our system of jurisprudence. Scarcely had that vicious system, which until lately prevailed, for proving and enforcing the payment of small debts, been swept away, and the New County Courts become fairly established, than their jurisdiction (which was at first limited to the adjustment of debts of twenty pounds and under) received an extension, despite the opposition of the government, so as to take cognizance of debts of fifty pounds; and thus was a means of obtaining justice put within the power of a large class of suitors, who, for the most part, had been compelled to forego their rights, and quietly submit to be defrauded, because of the costliness of law proceedings. It is needless to go so far back as the period when Lord Brougham occupied the woolsack, for instances of a marked progress towards a more simple and efficient administration of equity; for the recent "orders" of the present Lord Chancellor will shew, that advance in this desirable direction is the order of the day. But, by far the most satisfactory indication of a desire to meet the wants of the times and the wishes of the people, in matters of jurisprudence, is to be seen in the fact, that an association, recently established for the reform of our laws, has not merely been countenanced by men of the first standing in both the courts of law and equity, but has received their active and zealous support. This fact would shew, if Sir Bulwer Lytton's theory—that opinions travel upward—be correct, that the inadequacy of our system of judicature is pretty universally felt by the people: it is not, therefore, to be wondered at, that the mode of administering justice, in cases of infringements of patents, should have received the maledictions of patentees, more especially as their attention has of late been so earnestly called, by the whole press of the country, to the anomalies of the patent laws. The uncertainty of the law, in respect of the validity and infringements of patents for inventions, coupled with the cost of legal proceedings, seems to be a theme on which all patentees and inventors are at harmony. It is not in litigation as in the granting of patents, that exceptions are taken to the policy of reducing the cost; and yet we think that nothing reasonable has been advanced towards the attainment of this object, or for rendering decisions more satisfactory. In a former paper we offered

* Stevens and Norton, Bell-yard.

a suggestion, which might, perhaps, had it been acted upon, have, in great part, prevented the necessity for instituting proceedings in the courts of law to settle questions of disputed patent rights. This was to establish a Court of Appeal, which, although possessed of no legal authority, should, through its constitution, have the prestige for wisdom, as well as impartiality, in its judgments; and thereby be enabled to throw obloquy on any infringer who acted in defiance of its award. It does not, however, appear that men, well versed in matters of science, are easily to be found, who also possess the quality of mind necessary for seizing upon the points at issue in cases of infringement of inventions. Of this we are the more convinced by the many suggestions which have emanated from quarters where the ability might fairly be supposed to exist, for remedying the uncertainty which hangs over the decisions of patent cases. One reformer will have it that the subject-matter for a patent should be properly defined, so that an inventor might know when he is entitled by law to a patent. Another proposes that a patent, when once granted, shall be unassailable. A third, finding the difficulty so great in getting justice from the courts in which patent cases are now tried, would transfer the consideration of such matters from special juries, directed by the most eminent men on the bench, to county and stipendiary magistrates' courts, as a more fitting kind of tribunal. That great hardships are occasionally experienced, from the incompetency of the present tribunals to try patent causes, we cannot deny; for we could point to cases where the judge, jury, and counsel, were all alike at fault, and incapable, the one party of raising, and the others of understanding, the points really at issue; and it is upon these points, which, to discover and elucidate, require a mingled knowledge of law and science, that men of eminence in any given art that may be brought into question will in general be found unable to decide. The most rational suggestion, therefore, which has been made respecting the mode of trying patent cases, viz., that a jury, composed of men practically acquainted with the manufacture to which the disputed patent right referred, should be called, to decide upon the matter, is open to grave objections, and will, we fear, be impracticable, until mankind has formed the habit of resolving every question of moment by reference to first principles.

It may be thought that we are throwing a halo of mist around a subject already sufficiently involved; but what we would desire to enunciate is simply this—that however complex a question may at first sight appear, it is capable of being stripped of much extrinsic matter (which alone will frequently create the apparent difficulty) and resolved, as the chemist would say, into its

simple elements. Now, with respect to inventions, we think this may always be done; and certainly no specification can be properly drawn, without the invention being (so to speak) individualized in the writer's mind. It does not, however, necessarily follow that it is advisable to frame the specification in a manner that the elements, which go to make up the invention, shall be set forth as patent to the world; and yet we affirm that, without such an insight into the nature of the invention, no question as to its validity with respect to other patents, or of any alleged infringement upon it, can be satisfactorily decided. A patentee will frequently feel that his neighbour is working a machine which *ought* to be considered an infringement of his rights; and yet he cannot tell you why; for his neighbour's machine is, perhaps, much more efficient than his own; and the construction of the two, as respects their parts, is totally different. His conclusion will be—that "I started the idea, and he has robbed me of it;" and yet this first inventor will do nothing to defend himself; for he will be advised that he has no legal claim for redress. But how is this? Can the law be so defective that an original invention may be thus easily set aside? The defect, we would answer, is not in the law, but in the practice; for, had his specification been drawn under a clear perception of the nature of the invention, a definite step in advance of the prior existing stock of public knowledge would have been made apparent to the world: but, as it is, he claims, we will suppose, merely the construction of the parts as shewn and described, which may be varied *ad infinitum.* Thus, on carefully examining any case, in which a patentee's rights in a new and useful invention are virtually voided by the skilful re-adaptation of his own idea, or are left unrecognized by the courts of law, although appealed to for redress, we shall find that the essential features, or peculiar characteristics of his invention, have been lost sight of; and it is in consequence of this remissness, either in the preparation of the specification, or in the getting up of the case for trial, that the law is held to be unjust and oppressive.

In the work which forms the title of the present paper, the following passage occurs, which supports our position—that questions relating to the voidability of patents can only be determined by reference to first principles. Mr. Spence, in speaking of patentable invention, says,—"An abstract physical principle is not patentable, because it is not, in any sense, a manufacture. The discovery of it may be useful, and very meritorious; but it must be rewarded in some other way. Still a manufacture may embody a principle; *and I affirm that it does so universally,—that, in point of fact, no result*

comes out from its use except as an effect of the working of its essential principle." And, again,—"Patentable invention is not here said to be a principle of any kind, but only of a particular kind—an embodied principle. It must be one which actuates a body existing in some material form, and constitutes, when thus embodied, a manufacture." Now, if this be true—and we think that, had our space permitted, we could have instanced sufficient examples from our own pages to prove the case—it follows that, in the absence of minds properly constituted to discern the "embodied principle" (or, as it is more generally expressed, to ascertain the nature of the invention), a feeling of uncertainty must continue to prevail respecting the result of legal investigations of patent matters; but, whenever legal advisers, counsel, and judges, are found capable, on the one hand, of ascertaining, and, on the other, of comprehending, the grounds on which the contending parties ought to rely, there is comparatively little difficulty in coming to a just decision. The constitution of our courts, for the trial of patent causes, should not, therefore, be complained of, merely because incompetent parties are occasionally called upon to advocate and adjudicate upon this peculiar class of questions; for, under no other form of judicature that might be devised, would the means exist of ensuring that competent parties should invariably preside over and conduct the proceedings. It should be also remembered that, when men can be found, who, from their occupation or natural bent of mind, are capacitated to examine analytically matters of this nature, their powers, under the present system of judicature, may be brought to bear, as scientific witnesses; and it not unfrequently happens, that upon the evidence obtained from such channels the decisions of the courts are based. This is a fact of considerable importance, and deserving of serious consideration, as the biassed opinions of a scientific witness, when looked up to as an authority, are calculated to go far towards frustrating the ends of justice. On this point, the author, whom we have already quoted, seems to possess a wholesome fear. He says,—"It is well known that there is a kind of scientific witness that is most adapted for the plaintiff, and another for the defendant, in a patent case. The man skilled in the power of expanding narrow points suits the plaintiff; and he who can multiply plausible objections to the invention, as a substantive thing, suits the defendant. Now, the state of things which fosters the growth of two rival theories systematically called into exercise, has a tendency to substitute an art or science of giving evidence for a plain disclosure of facts." He, therefore, after defining the kind of scientific evidence that should be receivable in patent cases by

reference to the law of extrinsic evidence (as expounded by Wigram & Jarman), proposes—as a remedy to the evils which obtain under the present practice of receiving scientific evidence—that the examination of witnesses shall commence with "those witnesses called 'practical,' who can, by their testimony as to *facts*, lay a foundation, upon which may be built the superstructure of theoretical *opinion* derived from the higher class of scientific witnesses." In this manner, the author conceives "that the judge will be more effectually assisted than at present in obtaining materials for forming an accurate judgment upon the points in issue before him; and this plan is also likely to obviate, in a great measure, the chance of the recurrence of such conflicting scientific testimony as has been frequent, by enabling counsel to test the opinions of the scientific men in a much more searching manner." The value of this suggestion, we think, is somewhat doubtful; for it would seem, at the first blush, to indicate that the scientific witness must come into court in profound ignorance of the points at issue—that during the progress of the trial he is to collect the facts on which to found an opinion of the merits of the case—and, without having had time for reflection, he is to deliver his opinion just prior to the judge's summing up, which is to be, more or less, an echo of the extrinsic evidence given by the scientific witness. We will not say this is the intended bearing of Mr. Spence's suggestion; but we think, without any straining of his words, the meaning we have assigned to them might be fairly deduced.

From the above extracts, it will be seen that our author is strongly impressed, and most justly so, with the importance of properly receiving the evidence of scientific witnesses in patent cases; for an undue yielding to, or a disregard of, their opinions would be alike injudicious; and it is frequently impossible to steer a middle course. So long as men of scientific attainments will condescend to act as partisans, and counsel will confine their studies to the law, we see no remedy for existing inconveniences; for, if the scientific witness (who is often the only man capable of fully appreciating the merits of the case) were banished from the courts, we should have judgments more frequently pronounced in ignorance of the real points at issue than at present, although his biassed views do not unfrequently give a wrong turn to the whole proceedings. Could we be certain that, from amongst this class, men might be found of the right calibre of mind for stripping a question of its complexities, and referring it to first principles, —and therefore qualified to act as a kind of judicial committee,—we might be disposed to advocate the establishment of a court similar to that described by Mr. Dudley Field, as re-

cently instituted in the State of New York for the hearing of cases of libel; whereby all questions of infringement would be subjected to a fair discussion, with a view to their amicable adjustment, before the aggrieved parties could avail themselves of the courts of law. This would, doubtless, if properly conducted, dispose of a great number of cases, and yet leave the present courts as a *dernier ressort*; but the ultimate expenses of a trial would be thereby considerably increased. Whichever way, therefore, we turn, we find inconveniences; but as an inquiry into the subject is of great moment to patentees, it may be well at a future opportunity to give it further consideration.

NEW METHOD OF QUANTITATIVELY ESTIMATING TIN IN ANALYSIS.

BY M. CH. MÈNE.

[Translated for the London Journal of Arts and Sciences.]

UP to the present time tin has always been quantitatively estimated in chemical analysis under the form of peroxide of tin, or stannic acid. The difficulty, or rather the minute care, necessary in separating this substance—the time required in its washing and desiccation, and, at the same time, the unavoidable inaccuracy of the process, have made it an obstacle to exact analyses of compounds in which tin is present.

The new method, which has been employed with success, is founded upon the employment of a certain test solution, of a standard strength. The process possesses a simplicity, rapidity, and certainty, which are unattainable by the old method. The chemical action upon which the estimation of tin, by the method under consideration, is based, is the property possessed by protochloride of tin to take chlorine from certain other salts in which it exists;—thus, if a solution of perchloride of iron (Fe_2Cl_3), an orange-colored fluid, be poured into a solution of protochloride of tin ($Sn.Cl$), a perfectly-colorless fluid, the salt of iron will give up to the tin one atom of its chlorine; passing into the state of protochloride (Fe_2Cl_2), a colorless compound, raising the protochloride of tin to the state of perchloride ($SnCl_2$), a salt likewise colorless. The decoloration of the salt of iron will thus take place, so long as any tin remains in the state of protochloride; but, as soon as the whole of the tin is brought into the state of perchloride, the slightest addition of the test-solution of perchloride of iron will color the solution to be tested with a more or less bright orange-yellow tint. This would mark the end of the operation; and, as the test-solution is of a known or standard strength, the quantity of tin can at once be known by calculation.

This method of analysis is already so generally employed in laboratories, that it will not be requisite to enter into any details

besides those necessary in the examination for tin itself. In performing an analysis by this means, one or two grammes of the matter to be examined must be introduced into a flask or mattrass, of the capacity of about a pint;—a mixture of one part of nitric acid, with six of hydrochloric acid, is to be added; heat must be applied until the mixture has boiled sharply for a short time; or, better, until the fluid becomes yellow, and smells strongly of chlorine:—at this time the tin is in the state of perchloride. Zinc is now put into the mattrass, until the liquor becomes clear and colorless. In dissolving, the zinc reduces the tin to the state of protochloride,—that is to say, the zinc precipitates the tin in the metallic state; but the excess of hydrochloric acid re-dissolves it, immediately bringing it into the condition of protochloride; in which state it exists in the fluid to be tested. When the solution is thus prepared, it is ready for the addition of the standard test-solution of perchloride of iron;—this is added by means of a graduated pipette, from which the test-solution is poured into the fluid containing the zinc, until a certain determinate effect is produced. The quantity of tin present in the original compound is determined by a simple calculation from the quantity of perchloride of iron added.

It is advisable to dilute the solution to be tested, particularly when it contains copper.

When the examination is to be made upon a compound of tin and other metals, such as copper, lead, &c. (substances which are insoluble, or, at least, very sparingly soluble, in hydrochloric acid), the zinc, as described above, decolorizes the fluid, and precipitates these metals in the metallic state; their particles collect at the bottom of the flask, and do not in anywise prevent the action of the solution of iron from being perfectly seen. When, on the contrary, metals are present which are soluble in hydrochloric acid, such as iron, they are brought into the state of protochloride, and, similarly to those which are insoluble, offer no impediment to the operation of the test; as their affinity for chlorine is less than that of tin and protochloride of iron for the same substance. Arsenic affords the only exception to the above rule: when this substance is present with the tin, the compound must be subjected to a preliminary experiment before dissolving it, for the purpose of applying the iron test. The object of the preliminary treatment is to get rid of the arsenic. This is effected by heating the compound for some time in a crucible lined with charcoal: the arsenic is volatilized; but the tin, and other (not volatile) metals, remain unchanged. This mixture is dissolved in the acid, and the process passed through, which has been already described.

The earthy bases, such as lime, baryta, and alumina, do not present any difficulty in the application of this method of analysis.

Before bringing to a termination the account of the operation of the new process, it will perhaps be desirable to point out a convenient and easy method of procuring the perchloride of iron. It is important, in making this test-solution, to employ a salt quite free from nitric acid; for, otherwise, in the analysis of

alloys of tin, it would act upon the other metals present, and, oxidizing them, produce serious and unavoidable errors. To make the perchloride of iron, precipitated peroxide of iron, or colcothar, may be very advantageously used;—this should be boiled for about ten minutes with pure hydrochloric acid, and then filtered: the liquor thus produced does not change spontaneously, but may be kept for an indefinite period. Perchloride of iron may be made to crystallize by concentration or cooling; but the loss which occurs in the process—the variable and accidental nature of the products formed—the inutility of taking the necessary pains—are so many reasons why the crystallized perchloride ought not to be employed.

To make the standard test-solution, it appears scarcely necessary to give any instructions. The plan is, however, to weigh out exactly one gramme of pure tin; remark accurately the number of measures of solution of perchloride of iron from the graduated pipette required to bring the tin to the state of perchloride, judging by the color, as already described; then compare it, by calculation, to the results of the analysis. The employment of this method of estimating tin is so simple and familiar to chemists, that any further details seem to be quite unnecessary.—[*Comptes Rendus.*]

ON THE RED COLORING MATTER OF MADDER.

BY MM. WOLFF AND A. STRECKER.

MADDER contains two peculiar red coloring principles, which were long since named by MM. Robiquet and Colin, alizarine and purpurine: these are the substances which M. Runge has described under the name of krapproth and krappurpur. M. Debris has termed them lizaric and oxylizaric acids. The composition of alizarine is expressed by the formula

$$C_{20}.H_6.O_6$$

which corresponds exactly with the results of the analysis of MM. Schunck and Debris. Alizarine is a feeble acid, and is capable of uniting with bases in numerous proportions. The following is a list of the salts of this substance, which have been analyzed, and the atomic constitution calculated:—

Hydrate of alizarine....	$C_{20}.H_6.O_6+4HO$.
Alizarate of lead	$2(C_{20}.H_6.O_6)+3(PbO)$.
Ditto ditto	$3(C_{20}.H_6.O_6)+4(PbO)$.
Ditto of lime	$2(C_{20}.H_6.O_6)+3(CaO-HO)$.
Ditto of baryta........	$C_{20}.H_6.O_6+2(BaO)$.
Ditto ditto	$2(C_{20}.H_6.O_6)+3(BaO-HO)$.
Ditto ditto, dried at 120°,	$2(C_{20}.H_6.O_6)+3(BaO)$.
Ditto ditto	$3(C_{20}.H^6.O_6)+2(BaO)$.

Chloronaphthalic acid, $C_{20}.H_5+Cl.O_6$, discovered by M. Laurent, consists, as is demonstrated in the formula of alizarine, given above, of that substance combined with chlorine: this acid, it is well known, forms with metallic oxides salts of a red or yellow color. It has hitherto been sought, in vain, to transform chloronaphthalic acid into alizarine, either by means of the amalgam of potassium,

or by an electric current acting under the influence of an alkaline solution. There cannot, however, be much doubt but that, ultimately, chemical research will point out a means of producing practically a reaction, which theory shews to be perfectly possible.

Alizarine, treated with nitric acid, produces oxalic acid,—and also a volatile acid, termed by M. Shunck olizaric acid, and in which MM. Gerhardt and Laurent have recognized phthalic acid: indeed it has been proved, by the elementary analysis of the salt of silver, which has given the composition $C_{16} . H_4 . Ag_2 . O_8$, that alizarine is partially converted by nitric acid into phthalic acid. The following formula shews the nature of this transformation:—

$$\underset{\text{Alizarine.}}{C_{20}H_6 . O_6} + O_8 + 2(HO) = \underset{\text{Phthalic Acid.}}{C_{16}H_6O_8} + \underset{\text{Oxalic Acid, 2 atoms.}}{C_4H_2O_8}.$$

M. Laurent has discovered that chloronaphthalic acid is likewise transformed, under the influence of nitric acid, into phthalic and oxalic acids. This is fresh proof of the intimate connection which exists between chloronaphthalic acid and alizarine.

Purpurine, the second of the red coloring matters of madder, has the composition $C_{18} . H_6 . O_6$. It differs from alizarine in containing two equivalents less of carbon. It gives, as well as alizarine, all the various tints of color which can be obtained from madder by the action of mordants of different kinds.

Adrianople red, produced by purpurine, has a finer color (less blue) than that which can be obtained by the use of alizarine. Purpurine is separated from alizarine by a concentrated boiling solution of alum, in which it dissolves, leaving the insoluble alizarine behind. Purpurine gives, with caustic potash, a greenish-red solution; while the color of the potash solution of alizarine is of a pure blue, seen by reflected light,—but appears purple when the rays of light pass through it to the eye.

Purpurine, treated with nitric acid, is (like alizarine) converted into phthalic and oxalic acids. The nature of the transformation is represented in the following formula:—

$$\underset{\text{Purpurine.}}{C_{18}H_6 . O_6} + HO + O_5 = \underset{\text{Phthalic Acid.}}{C_{16}H_6 . O_8} + \underset{\text{Oxalic Acid.}}{C_2HO_4}.$$

In madder which has been brought into a state of fermentation by the addition of yeast, at the temperature of 30° Cent., purpurine alone has been found;—the alizarine had disappeared, being probably converted into purpurine,—a change which may readily take place with the disengagement of carbonic acid and free hydrogen gas.—[*Ibid.*]

INSTITUTION OF CIVIL ENGINEERS,

Nov. 26th, and Dec. 3rd, 1850.

WILLIAM CUBITT, Esq., President,—in the Chair.

The discussion on Mr. Struvé's paper, on "*The ventilation of collieries, theoretically and practically considered,*" was continued throughout both the evenings, to the exclusion of any other subject.

The principal points of the paper were explained to the members who were not present at the reading of the paper. Great stress was laid on the advantages of splitting the current of air, so as to reduce the velocity of its transit through the mine, and to afford a full supply to the most remote points of the workings.

The high temperature in the upcast-shaft, necessary to produce the requisite velocity of current in the galleries of mines, when furnaces were employed, was adduced in favor of the employment of Struvé's mine ventilator, or other mechanical means of drawing out air through shafts which were also used for drawing the coal, or raising the men to the surface.

The wasteful application of steam, in the form of a jet, was insisted on, and contrasted with the small power actually employed at the Eaglesbush Colliery, for giving motion to Struvé's mine ventilator.

These statements were fully confirmed. It was shewn, that the speed of the mine ventilator could be regulated to produce any requisite velocity of current in the galleries; and that it was an efficient indicator of the occurrence of any stoppage in the air-passages, as, on the supply of air being arrested, the machine would soon be stopped.

In the best mines of the North furnace ventilation was found to be most efficient; and the stated danger apprehended from the firing of the gas at the furnace was concluded to be more ideal than real. Nevertheless, it was admitted, that a good simple mode of mechanical ventilation merited the best attention of the owners of collieries. Fans for forcing air down into mines had been tried; but were found inefficient, although considerable power was consumed in propelling them.

The difficulties found in using mechanical exhausters were then attributed, in a great degree, to the small size of the inlet and outlet-valves; and the improvements introduced by Dr. Arnott, in the apparatus for ventilating the New County Hospital, at York, were instanced as examples of the necessity for using curtain-valves, of large area, for the machines, as it had been found that, as the dimensions of the valves were increased, the power required to work the machines diminished. The most beneficial effects had resulted from the use of ventilating-machines, similar in principle to Struvé's mine ventilator, in hospitals, and on board crowded emigrant and convict ships; and, by proper attention to the area of the valves, the power required to work them was very small. The application of small water-power engines, like those made by Mr. Armstrong, of Newcastle, for giving motion to the ventilating-machines, was recommended as very effective and most economical.

The importance of large air-channels, in short lengths, for furnishing ample supplies of air under ground, was admitted by other speakers, who, however, objected to the application of mechanical ventilation,—preferring its being effected by natural means, which it was contended could be attained by a judicious system of "winning" arrangements. When, however, this was not prac-

ticable, Struvé's apparatus was approved as the best hitherto introduced. A somewhat similar but less perfect system had been used for some years in Germany, Prussia, Belgium, and in some mines in England.

The system of sinking shafts on the dip, for the advantage of collecting water, without considering the tendency of gas to accumulate in the upper cavities of the workings, was deprecated, and the more advantageous plan proposed of having the downcast shaft on the dip, and the upcast on the crop; whereby an easier exit would be provided, and a more effective ventilation be established.

The application of the steam-jet was advocated, and instances were given of its efficiency in clearing the after-damp from pits where explosions had occurred. It was argued, from experiments, that the steam-jet could be rendered much more efficient than the furnace; but no statement of the relative expense of this plan, as compared with mechanical ventilation, was entered into.

The evidence given before the House of Commons in 1835, the House of Lords in 1849, and to the South Shields Committee on accidents in coal mines in 1843, was carefully analysed, with the intention of demonstrating that, beyond certain limits, it was useless to force furnace ventilation, as, under certain circumstances, a current of cold air was found to descend the upcast-shaft, forming a false brattice, and arresting the ventilation. The steam-jet was stated to be capable of such increase of power, and of such varied application, as not to be subject to this inconvenience.

It was contended, on the other hand, that, in reality, this natural brattice was seldom perceived, and that, when it did occur, the system of scaling off a portion of air, at some distance up the shaft, sufficed to destroy it.

It was shewn that mechanical ventilation was essential to clear away the choke or after-damp, so as to enable a mine to be entered after an explosion, when it might be dangerous to light the furnace at the bottom of the pit; but by setting the machine at work with increased velocity, a much greater circulation of air could be caused under any circumstances of barometrical pressure, and the mine could be cleared in a short time. Had this system been adopted, the dreadful effects of the choke-damp after explosions would have been frequently obviated, and much waste of human life might have been avoided.

The discussion was adjourned until the next meeting.

December 10th, 1850.

The discussion on Mr. Struvé's paper, on "*The ventilation of collieries, theoretically and practically considered,*" was continued throughout the evening.

The steam-jet, in its application to the upcast-shaft, was again considered; it was argued, that like the furnace, it did not produce any pulsation in the current of air, which was so very wasteful of the power for giving motion to all means of mechanical

ventilation; and, therefore, that by the accepted laws of physics, the steam-jet set in motion a body of air, which continued to flow without intermission through the galleries and the upcast-shaft, subject only to the deduction for the pressure of the atmosphere, and the friction of the column of air on the surface over which it passed. It was shewn that, to obtain the full and effective action of the steam-jet, precautions must be adopted, in bringing it down a certain distance, so that the jet should act conically; and a variation of the distance between the jet and the extremity, or apex of the inverted cone, would produce a corresponding variation in the degree of rarefaction. The jet was stated to act equally efficiently, either at the top or the bottom of the shaft, although it was admitted to be more costly in the former situation. Its application at the Ebbw Vale Collieries was asserted to be very effective; and, as only the surplus steam was employed, it was in that instance the most economical system that could be used.

On the other hand it was contended, that in mechanical ventilation, the pulsation of the air was only perceived where the valves were heavy, or were of contracted area; that, practically, it was more to be relied on than any other system, and that the safety afforded by it was superior to the furnace, or the steam-jet; as, under circumstances of danger, or after an explosion, it could be brought into immediate action, with increased energy, to meet the emergency, and be the means of saving human life.

In summing up the discussion, the evidence given before the House of Lords in 1849 was again minutely analysed, with the view of shewing that the deductions previously drawn were not correct, inasmuch as the results obtained were owing to temperature, and not to the exhaustion created by the steam-jet. The published opinion of M. Combes,—"that the useful effect of the steam employed to produce the motion of the air, by projecting it into a tube, is in all cases much below what it is capable of producing when applied to a steam-engine working mechanical ventilators of the most imperfect description," was quoted in support of these views.

It was considered, that a current of air in the upcast-shaft of at least 18 feet per second was most desirable; to produce which a motive column of air of 137 feet would be requisite; and this could not be attained where ventilation by means of a furnace, or of a steam-jet at the bottom of the pit was used, without raising the temperature to such a degree as would be impracticable in bratticed shafts, or in shafts used for winding coals, or for the passage of men. It was then shewn, that the steam-jet applied at the top of the upcast-shaft, and acting merely by rarefaction, would be too costly for general adoption; whereas, if the combined area of the pumps of Struvé's mine ventilator was sufficiently large to equal the aggregate amount of the splittings of the colliery, it would only require one-sixth of one-horse power for every superficial foot of the upcast-shaft. It was shewn, that no pulsation in the current of air was perceptible in the Eaglesbush Colliery

(where Struvé's mine ventilator had been in use for nearly two years) at a greater distance than 100 yards from the machine, and could not, therefore, extend prejudicially into the workings. It was mentioned that two other machines, similar to those in use at the Eaglesbush colliery, were in progress of construction for two collieries in the neighbourhood of Swansea.

M. Leteret, an eminent mining engineer, had asserted that no similar machine to Mr. Struvé's had ever been used in Belgium, and that he thought it, both for utility and economy, superior to any mechanical ventilation which had yet been introduced.

At the close of the regular business, Mr. Beckers exhibited and described a self-acting siding-stop, whieh was now in use on the Great-Western Railway. A portion of the ordinary rail was cut, so as to admit of the movement of the stop, which was of iron, about 1½ inches thick, and projected above the rail about 9 inches; this was attached to one end of a shaft, and on the other end there was a bent lever, which carried a signal disc above, and a counterbalance weight below. The object of this simple and inexpensive machine was to remove the liability to accidents from carriages, or trucks running out of a siding on the main line, as occurred some time since at Wootton Basset; for whilst it permitted a train of waggons to pass into the siding, the wheels themselves depressing the stop, it presented an absolute bar to any waggon leaving the siding, unless some person held down the lever so as to lower and remove the impediment.

DECEMBER 17TH, 1850.

The Annual General Meeting for the Election of the President, Vice-Presidents, and other Members of Council, for the ensuing year, and for receiving the Annual Report of the retiring Council, was held on this evening.

The Report was rather more explicit than usual; and, whilst congratulating the members on the increased attendance at the meetings, the high value of the original communications, and the practical character of the discussions which ensued on their being read, it urged the necessity of organization amongst the great body of the civil engineers generally, as well for the purposes of professional advancement, as for protection of their interests—their rights and privileges,—which had of late been invaded by persons not regularly brought up to the profession. It was shewn, that as this Institution was the most natural, so it was the only ready means by which this desirable end could be properly and effectively carried out; and how absolutely essential it was that it should receive the cordial support of every civil engineer, who had the honor and credit, both of himself and of his calling sincerely at heart. The same necessities which had, many years ago, called this Institution, the first of its kind, into existence, had lately induced the establishment of similar societies in several chief towns of Great Britain, and the spirit had even extended to foreign countries, where the evils of the centralization system, and of the

interference of Government Boards, had been severely felt: all these societies had taken this, the parent society, as a model in nearly every particular.

The principal papers which had been read were noticed, and their objects and merits explained in a few expressive sentences. For these, the following medals and premiums were awarded:—Telford Medals, to Messrs. Armstrong, W. H. Barlow, W. Taylor, Thorneycroft, the Rev. J. C. Clutterbuck, M.A., Chubb, Turner, and Paton, and Lieut.-Col. Lloyd, and Professor Cowper; and Council Premiums of Books to Messrs. Neate, Hood, Mallet, Doyne, Paterson, Poingdestre, and Lawrence.

The finance statement exhibited, in some respects, an improvement over the last year; the current subscriptions were more closely paid up, and an accession of funds, to the extent of nearly £3,000 stock, from the division of the residuary estate of the late Mr. Telford, the first President and Founder, had been recovered, in the month of August last, from the Court of Chancery; and for this the Institution was in a great degree indebted to their late President, Mr. Walker, in whose name the suit had been carried on, and had finally been brought to a successful issue.

Though the deceases and resignations were more numerous than usual, there had been an increase in the number of members, which now amounted to six hundred and eighty-one of all classes. The deceases included the names of many gentlemen eminent in their profession, and of that great statesmen, Sir Robert Peel, whose untimely end, not only this country but the world at large, so deeply deplored, and who had shewn a marked desire to advance the interests of the Institution, and to bring forward its officers on all occasions. Memoirs were read of the Right Hon. Sir Robert Peel, Bart., M.P., Honorary Member; Sir M. I. Brunel, J. A. Galloway, J. Gibb, W. Handiside, Colonel Irvine, C.B.B.E., G. T. Page, J. Smith (Deanston), and R. Stevenson, Members; and J. Adams, P. N. Brockedon, E. F. Brown, J. Hoof, G. B. Maule, and J. Ransome, Associates.

In conclusion, the Council hoped that the members of all classes would consider how best they could serve and advance the interests of this Institution, which it was admitted had already been highly beneficial, by uniting in the bonds of good fellowship, and for mutual advancement, a body of men whose labours were so all-important, and had so direct an influence on the common weal.

The thanks of the Institution were voted unanimously to the President, Vice-Presidents, and other Members of Council; also to the Auditors and the Secretary, for their great exertions on behalf of the Institution, and to the Scrutineers of the Ballot, for the kindness with which they undertook that office.

The following gentlemen were elected to fill the several offices in the Council for the ensuing year:—William Cubitt, *President;* I. K. Brunel, J. M. Rendel, J. Simpson, and R. Stephenson, M.P., *Vice-Presidents:* G. P. Bidder, J. Cubitt, J. E. Errington, J. Fowler, C. H. Gregory, J. Hawkshaw, J. Locke, M.P., J. R.

M'Clean, C. May, and J. Miller, *Members;* and J. A. Lloyd and F. C. Penrose, *Associates of Council.*

Mr. W. Cubitt, President, returned thanks to the members for their punctual attendance at the meetings, from which much good had resulted; and expressed the fervent hope that during the next important year (1851), the high character of this Society might be fully maintained, and its usefulness be in no degree curtailed.

The meeting was then adjourned until Tuesday, January 14th.

INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

(*Continued from page* 365, *Vol. XXXVII.*)

The following paper on *railway carrying stock,* by Mr. W. A. Adams, of Birmingham, was next read:—

The object of the present paper is to discuss and analyse the various descriptions of railway carrying stock, with the purpose of suggesting such improvements in the details of form and manufacture as will materially reduce the gross or dead weight of the vehicles, without affecting their efficiency or strength.

This matter has been brought prominently under the writer's attention, from the fact that, upon leading lines of railway, the first-class carriages, for the conveyance of 18 passengers, have reached a gross weight of 5 tons, and waggons for the conveyance of a maximum load of 5 tons, have reached a gross weight of 4¾ tons. These, it is to be observed, are probably extreme cases; but, being modern, they evidence the tendency to increase the weight of trailing stock.

It is scarcely needful to remark that, if a locomotive engine is capable of conveying a train of 50 waggons, weighing 200 tons, and the load 200 tons (which proportion will not be short of the truth, even without taking empties into account), a saving of one ton in the weight of each waggon will enable the engine to convey 50 tons additional of waggons and load, or equal to a saving of one-eighth in the cost of haulage.

In the important matter of inland through coal traffic, the waggon averaging 3 tons 15 cwt. carries 5 tons of coal. But, as the waggon of course returns empty, for 5 tons of coal conveyed one mile, 7 tons 10 cwt. of waggon have been conveyed the same distance. In this instance, the saving one ton weight in the construction of the waggon would be equivalent to a total saving of nearly one-sixth in the cost of haulage; that is to say, if the present rates are remunerative, the prices may be reduced 16 per cent.,—inducing a much more extensive traffic, and better enabling railways to compete with water conveyance.

Inland coals are mostly conveyed in waggons belonging to the collieries, or rented to the collieries by private individuals; and

in either case the tonnage or mileage charges on the railways are irrespective of the weight of the waggons: the object of the waggon owner is to produce such waggons as will be most durable with the smallest amount of first cost. The weights of colliery waggons have been gradually increasing,—each new lot being made (as was recently observed by the manager of an extensive inland colliery) of such a strength and weight that, in the event of a collision, they may break their neighbours and remain uninjured themselves.

Engine and carriage superintendence are generally distinct departments. The carriage superintendant aims at the utmost economy of maintainence in his department, and produces carriages and waggons, which, though very lasting and very serviceable, are meanwhile greatly increasing the expenditure of the locomotive department. It would appear that in no case has the interest of the parties directly concerned been to decrease the weight of the vehicles.

The heavy trains handed over to the locomotive department to haul, induced the construction of more powerful and weightier engines, until the maximum was quickly reached and checked by the sufferings of the permanent way. It is to be observed, that the writer has no desire to carry the question of light vehicles to any utopian extent, but simply to calmly study and elucidate, by experience and experiment, the practical means of reducing the weight of vehicles within proper bounds.

At the period of the commencement of railways, passengers were mostly conveyed by four-house coaches, light goods by vans, and heavy goods by water. It is the intention of the writer of this paper to confine the enquiry to wheel-vehicles. The great distinction between road and railway vehicles is, that railway vehicles have to sustain longitudinal strains in the direction of the buffing, as well as lateral and perpendicular blows. The four-horse coach, weighing 19 cwt., conveyed 18 persons with luggage, weighing in all 1 ton 7 cwt., at a rate of ten miles per hour. The four-horse Brighton van, weighing 1 ton 11 cwt., conveyed 6 tons of goods at a rate of four miles per hour. Every pound was carefully saved in weight of construction of the above vehicles. The timber was carefully-selected English ash; not that ash was the most lasting and durable, but that for strength and toughness it was unequalled in lightness, though short in its period of duration. The axles and the iron-work were wholly made of the best marks of scrap-iron. Skilled and costly labour of a high class was employed in the forging and fitting of the iron-work and the construction of the wood-work. In all cases where extreme strength was required, the timber was carefully plated with iron; whereby the utmost strength, with the smallest amount of material, was obtained. Builders competed, not so much in price, but, as artists, to produce, by proportion of parts and materials, the utmost result with the least weight. The gradients were bad, the roads imperfect, the motive power limited.

The wear and tear of the carriage was a secondary consideration to the cost of hauling power. The vehicles were probably as near perfection as man's ingenuity could produce them.

Simultaneously with the four-horse coach and van, was the conveyance of coals upon tramways with horse-power.

The writer will confine his observations to that district with which he is practically acquainted—that of Monmouthshire. The Act for the making of the Sirhowy and the Monmouthshire tramways, a total length, exclusive of branches, of 26 miles from the mines and ironworks to the shipping port of Newport, was obtained in the 42nd of George III., and, consequently, 48 years since; and that tramway has been worked until within the last twelve months by horse-power.

Originally it was a tramway, with fish-bellied cast-iron plates, laid and jointed upon stone blocks, with 6-feet bearings. These have gradually given place to rolled plates of malleable iron, weighing about 80 lbs. to the yard, and laid in chairs upon cross wood sleepers, with 2-feet 8-inch bearings.

The gross weight of the class of waggon (or, as it is locally termed, *tram*) used upon this tramway was 16 cwt., and it carried 3 tons of coals at a rate of three miles per hour, exclusive of the time consumed at the various public-houses by the tramway-side. The breaking or skidding down the inclines was effected in the most complete manner by means of a slipper or shoe, similar to that of a stage coach; as also was the stopping of the train, by thrusting a bar of wood through the spokes of the wheel, or, as it is locally termed, spragging the wheel. The unloading was effected by means of a gallows and crab,—the tram being raised at one end, and the coals discharged by means of the swinging tail-board at the other end. No provision was made for buffing; but the train was articulated by the mode of hitching the waggons together. The wheels ran loose upon the axles, and were, in most instances, dished in the manner of a common road-wheel, thereby illustrating the first advance from a common road-vehicle.

The tramway is mostly an incline from the mines to the port. Six horses brought down 60 tons of coals and 16 tons of trams. The same power was required to take up the empty trams. Dead weight in the trams was consequently of vital importance. This tramway is now being worked with locomotive power and permanent waggons,—the Tramway Company finding power, and the freighters waggons. The same care which influenced the private hauler, and caused him to equalize his upward to his downward load, does not now influence the freighter, and has been lost sight of by the company. In the eye of the freighter the waggon which is strongest and heaviest is the best; and the consequence is, that waggons weighing 3 tons are conveying but 5 tons of load. The ratio of upward load was in the one case 21 per cent., and in the latter 37 per cent., as compared with the downward. The weight of waggon conveyed up hill was in the one case 27 per cent., and

in the latter 60 per cent., as compared with the coals brought down. In place of a perfect horse tram-road heavy engines are being hammered, and are hammering to pieces a bad road with bad gradients and extremely bad curves. This is wholly true, but fortunately an extreme case; nevertheless, it is questionable whether many lines are not also suffering in a lesser degree from the incubus of dead weight.

The Huntingdon and St. Ive's branch of the East Anglian Railway, $4\frac{3}{4}$ miles in length, is at the present time worked by a horse-carriage. This carriage is a composite carriage, consisting of three compartments, and carrying 60 passengers in all, inside and out. It is to be observed, that the carriage is made from an ordinary composite,—the under frame being completely taken away, and wheels, guards, and springs of the lightest construction substituted. The total weight is 3 tons; but the weight would not exceed 2 tons, if the carriage had been originally built for the present purpose. The horse is attached by an outrigger, to which the traces are hooked, and he travels by the side of the carriage, with his head tied up to the carriage, to prevent him from turning round. A brake is applied to the wheels.

The writer has instanced this carriage to illustrate that, when horse-power is brought into use, the weight of vehicle is at once considered; and also that the vehicle, being used singly, does not require strength to resist longitudinal buffing. The cost of working this carriage is sixpence per mile, including horse and driver, and the guard, who is also ticket collector. The pace is ten miles per hour; and it would appear that this application meets all the requirements of the limited traffic of a short branch.

Rapid strides were made by engineers in perfecting the way, and the locomotive. The facts relative to the permanent way have been discussed and appreciated, and the details greatly perfected. Locomotives have been improved, and the consumption of fuel brought probably nearly to the minimum; the details have been understood, discussed, and experimented upon by men of high talent and experience; but far different is it in the matter of carrying stock. The construction of the carriage and the waggon was, in the commencement, left wholly to men of long practice in carriage building for the common road, but not experienced in mechanical engineering. Those patterns originally set, have been copied and re-copied in an almost servile manner. When carriages and waggons have failed in their parts, the sole remedy has been increase of strength, by increasing the weight and quantity of material. Axles have increased from 3 inches diameter to 4 inches; tyres from $4\frac{1}{2} + 1\frac{1}{4}$ inches to $5 + 1\frac{3}{4}$ inches; and so on throughout.

The original London and Birmingham and Grand Junction first-class carriages, with three compartments, carrying 18 passengers, had dead weight $3\frac{1}{4}$ tons, cubical contents 504 feet.

The modern first-class carriage, with 3 compartments, carrying 18 passengers, has dead weight 5 tons, cubical contents 807 feet.

The dead weight of waggon, per ton of load, for the upward and downward journey of the old Monmouthshire train was $\frac{1}{3}$ ton; that of the new Monmouthshire waggon is $1\frac{1}{8}$ ton; and that of the Derbyshire and Leicestershire coal waggon is $1\frac{1}{2}$ ton.

The writer presumes that it will be at once admitted, that reducing the dead weight of railway vehicles is extremely desirable, whilst such reduction of weight is effected with due regard to efficiency and strength to resist the longitudinal strain in buffing. Also that reduction in first cost is not the sole object to be attained, but to produce such vehicles as shall be (all points considered) the most economical in first cost, in maintenance, and especially in traction; but, at the same time, it does not follow that reducing the dead weight, and improving the quality of the materials, will add materially, if any, to the cost.

Should it be approved by the Institution, the subject of a second paper will be to analyse and compare the whole of the modern trailing stock with that of an earlier period, and thereby glean such information as will enable the writer to prepare and lay before the Institution, in a future paper, such improvements in the form and manufacture of railway vehicles as may lead to the result pointed out at the commencement.

It is proposed to try all necessary experiments as to the relative strength of wood and iron, and the combination thereof, in order to obtain the necessary information as to the most eligible and economical means of attaining the greatest strength with the least weight.

The Chairman observed, that the paper was one of great importance; but, as their time was expired, unless some member had any communication to make, it was better that the discussion should be adjourned to the next meeting. He might observe, that it was principally at his suggestion that the paper had been prepared, as he considered that nothing could well exceed the importance of getting rid of any unnecessary dead weight; and he hoped that, in the interval between the present time and their next meeting, the subject would receive the serious attention and consideration of the members.

Society of Arts.

MR. HENRY THOMAS HOPE, M.P., VICE-PRESIDENT, IN THE CHAIR.

Nov. 27th, 1850.

MR. MECHI read a paper on the present state of agriculture in England, and on his own farming operations at Tiptree Hall, Essex.

Mr. Mechi commenced by adverting to the slow progress made by agriculture as compared with that of other industrial occupations, and to the necessity for still further improvement imposed

on us by our rapidly-increasing population. His reasons for dissatisfaction are the low annual value of the acreable produce of the kingdom.

The author stated his belief that the very largest estimate per acre, taking into account the poor grass and arable lands, and leaving out market and other gardens, does not reach £4 per acre. A reference to Spackman's Occupations of the People, and other statistical works, shew that the rental of the United Kingdom (excluding towns) does not reach 15*s.* per acre. Taking, therefore, as a gross return, five rents (four would be nearer truth), it is clear that £3. 15*s.* worth of produce per acre is far too liberal an estimate.

But well-known facts shew that, by the use of better cultivation, and a better general method of farming, much larger returns can be got.

Even this year some of the author's potato land yielded £15 per acre, at the low price of 1*s.* per bushel; and the average of 80 acres of wheat will not be less (straw and chaff included) than £10 per acre, on a very miserable soil. There are in—

	Acres.	Rental per Acre.
England and Wales	36,995,000	21*s.* 8½*d.*
Scotland	18,944,000	5*s.* 1½*d.*
Ireland	20,177,446	13*s.* 5¼*d.*

(including the towns, and all the bog and waste lands).

Now, the mere increase of labour and production to the extent of 10*s.* per acre, would afford us all food and employment, without recourse to foreign imports. This object must be attained by the free will of a free people, stimulated by public discussion, comparison, and calculation.

The author remarked, that he had been forcibly struck with the prejudices and inconsistencies of agriculture. Railway-hedges are neatly trimmed and annually cultivated, like a crop of turnips; and they are thus rendered effective as well as neat: but farm-hedges, diverging at right angles from these, have never caught the pleasant infection. They still exhibit their huge, irregular, and ungainly proportions; shading and robbing the land, for the mere purpose of growing bushes to stop the gaps caused by their untrimmed and neglected condition. Farmers dig their gardens two feet deep; but only plough their land five inches. They take especial care of their nag horses in a good warm stable; but expose their farm horses and cattle to all weathers. They deny the utility of drainage in strong tenacious clays; but dare not dig an underground cellar in such soils, because the water would get in. They waste their liquid manure; but buy guano from Peru to repair the loss; and some practical men, who are in ecstacies with the urine of the sheepfold, have been known seriously to doubt the benefit of liquid manure. But, it may be asked, "Where is the capital to come from for all these improvements?" The reply will be, Where does the capital come from to make railways and docks, to build steam-vessels, to erect a whole town of new squares

and streets, and to carry out every other useful and profitable undertaking? Of late, many bankers, merchants, shipowners, manufacturers, traders, and professionals, have become owners or cultivators of our soil. These, not having the agricultural precedents or prejudices of their predecessors, are devoting their powerful means and energetic common-sense principles to the amendment of our agriculture and the increase of employment and of food. If you see arising on the ruins of our queer-shaped and antiquated farmeries a pile of substantial and convenient erections—if you see the smoking shaft and irrigated meadow, depend upon it it is the work of some new possessor. The establishment of public companies, with ample capital and sufficient legal powers to improve settled or encumbered estates, is also a pleasing event. The antiquated and semi-barbarous difficulty of transfer is a sad and most unjustifiable obstruction to landed investment and amendment. It appears a monstrous and intolerable nuisance, that the same principles of possession and transfer are not applied to land as to the funds. A public registry office, with district maps, would at once obviate the difficulty. Land would then change hands twenty times for once now, and have a proportionably increased chance of improvement.

The moral and physical condition of our labourers must be regarded as having a most important influence on our successful cultivation of the soil. It seems marvellous that, with the example of America before us, we should still leave this great question to the mere chance of individual or local beneficence. Our Scotch friends manage this matter better, and with economy too; and, as a consequence, supply us with bailiffs and gardeners.

The author recommends, as an advantageous arrangement, both for farmers and their labourers, to let every job at task or piecework. The work is more quickly and cheaply done; the men earn more money;—are, consequently, in a better physical and social condition, and larger consumers of the farmers' and manufacturers' produce. Every man who values the working condition of his horses will naturally extend the same consideration to his labourers. The social and physical pestilences resulting from the wretched hovels in which they are compelled to live, should make us wiser in this respect. Honor be to his Grace the Duke of Bedford, and to others, who have set a brilliant example, by providing ample and convenient residences for the peasantry on their estates.

The necessity for facilitating the carriage of farm produce is very obvious. In the good old times, which it is by no means desired to resuscitate, the father of a friend of the author's, when a farmer in Surrey, had to send his wheat to market twenty miles on pack horses, and sell it at 20*s*. per quarter! Our parish and farm roads are, many of them, at present sadly managed;—they should always be kept slightly rounding, so as to shoot off the water; scraped, repaired, and drained, like our turnpike roads.

In speaking of farm horses, the author said they should be

clipped early and gradually, piece by piece. They should never be turned out, but treated exactly as nag horses,—especial care being taken that there is ventilation at the highest point in the stable. All their hay and straw should be cut up into chaff, the corn ground into meal, and mixed with it. Two-thirds hay-chaff and one-third straw-chaff is the right proportion; but cut hay alone does not answer, being apt to ball in the stomach. If their water could always be warm, as at the London breweries, they might drink at any time. Animals never do well under slated roofs, unless you interpose a lining of boards or thick woollen felt. Slates conduct heat to the animal in summer, and from it in winter. Thatching under slate is useful, though apt to encourage vermin.

Deep cultivation after drainage is essential to profitable farming on heavy lands. This the author effects by removing the breast from a plough, and letting it follow, drawn by a pair of horses, in the track of the first plough. In summer he uses a very large plough, with four horses, to open the work, and follows with another plough and four horses in the same track. This brings up immense clods and blocks of the nasty undisturbed subsoil. When dried by the sun, the Crosskill roller, with 5 cwt. added, cracks them, the scarifier operates, and again the Crosskill renews the attack (all in dry hot weather), until you have a perfect garden,—yellow-looking, it is true, but aerated, and deprived of many noxious properties, and ready for mixing with abundant manure and calcareous matter. You thus bid adieu to root-weeds that have tormented you for years; you facilitate the percolation of water, air, manure, and roots. Your crops do not dry up in summer, or freeze in winter; for it is the drying or freezing of the roots that destroys the plant. This dry summer, all the manure for our root crops being within five or six inches of the surface, got dried, and the root crop failed. Not so where it was buried deeper, like garden cultivation, below the solar influences. Our root crops send down their roots many feet in summer, provided the manure is there, as has been proved by examination.

In referring to the potato question, the author remarked, that bad farmers, who do not keep much stock, or buy much manure, dare not grow potatoes with the ordinary mode of farming. He has heard them say a potato crop exhausts their land for years. But a heavy exhausting crop implies a heavy return, with means for restoring the deficiency occasioned by it. Miserable crops, occasioned by the save-all and cheese-paring principle, cause us to feel severely the pressure of our rent, tithes, and rates. They re-act on the landlord, labourer, tenant, and community at large.

As respects drainage, little need now be said, as, on all wet lands, good draining is generally considered indispensable as an agricultural basis.

In rearing much stock with cut or ground food, steam-power is indispensable. The author, when stopping his steam-engine

at any time for repairs, finds himself involved in a daily expense of nearly 20*s*. No doubt engines will be used to force water and liquid manure for irrigating the soil, as is done advantageously by Mr. Kennedy, of Myremill, Ayrshire.

The construction of farm buildings is a matter of considerable importance. The waste steam from the steam-engine, after passing under and boiling the necessary number of iron tubs or cooking coppers, should, in iron pipes, warm all the feeding-houses, keeping their temperature at a profitable heat for cheap fattening. In the passages (which should be rectangular, with a turn-table in the centre) might be placed a light cheap iron tramway, on which the feeding-carriage would work with facility, having on it the baskets of turnips or other food. This would economise much labour; and the feeder would no longer be in the position of the man who had to pick up a hundred eggs at intervals of a yard, having each time to return and multiply his labour.

Perhaps the *feeding on open boarded floors* is one of the most interesting questions of the present day. Experience will teach us that, in order to succeed in farming, we must produce a much larger quantity of meat on our farms than at present, and at less cost. In order to do this advantageously, it becomes necessary to consume a large portion of the straw of the farm, cut into chaff, and cook it with meal or ground oil-cake. We are thus deprived of the usual cattle bedding, and must find a substitute. The author having practised the system rather extensively, and found the balance of benefit sufficiently considerable to induce him to continue and extend it, recommended the consideration of his plan to cattle breeders; and, with this view, gave the following details:—He says, the quantity of stock I now have on boards is—

100 lambs	60 calves	50 cows
50 sheep	40 bullocks	200 pigs.

We are indebted to the worthy and Rev. A. Huxtable for the idea; but I found his space of three-quarters of an inch between the planks insufficient. I therefore measured the hoofs of the various animals, and arranged my openings accordingly. Thus—

	Inches thick.	Inches wide.	Inches space.
For bullocks	3	4	$1\frac{7}{8}$
„ sheep	$1\frac{1}{2}$	3	$1\frac{1}{4}$
„ pigs	$1\frac{1}{2}$	3	$1\frac{1}{4}$
„ small pigs and lambs	$1\frac{1}{2}$	3	1
„ calves	2	3	$1\frac{5}{8}$

On heavy lands, the area allowed for each animal and its feeding apparatus is—

	Superficial feet.
Small sheep	8
Large ditto	10
Small bullocks	30 to 40
Large ditto	50 to 60
Small pigs	6 to 8
Large ditto	9 to 11

But very much depends on the season and weather. In cold

weather pigs and bullocks can scarcely be packed too close, so long as there is room for them to lie down comfortably. Sheep require a little more room or ventilation. In fact, it requires a nice observation to adjust the ventilation and temperature. This is best done by a thermometer; because our own feelings are not always a sufficient criterion. Every cattle-shed should feel as comfortably warm as a drawing-room; for cold, stopping the circulation in the skin, drives the blood to the internal organs, and causes inflammation. The opening for ventilation should be at the highest point. Fine bred pigs, having little hair, must have a much warmer temperature than sheep. When pigs huddle together, it is a sure sign that they are not warm enough. I have often been struck on seeing how soon my groom will get a horse into condition by warmth, cleanliness, and food. My bullocks are all groomed daily by a boy, whose sole occupation it is. The cost is about one farthing per head per week; and I am sure it pays. Before I leave the open boards, I should say that the planks may be either of straight yellow deals, or of straight-grained hard woods. The latter are to be preferred for heavy animals, as they wear off the edges of the deals. The depth of the pits may be from two to four feet. It is necessary, once in a way, to level the manure, to prevent its touching the boards; as it would soften them, and cause them to break. We never sweep the floor; but the animals are perfectly clean. The manure is taken at once from under the boards to the field, without the interventional expense of a double carting, shooting, or turning over of a dungheap. The effect on the crops is unmistakeable. The cost of erecting covered homestalls, complete with boarded floors, will not exceed 1*s.* to 1*s.* 3*d.* per superficial foot; and, in order to pay you 10 per cent. on your investment for the building complete, you would charge your bullocks 1½*d.* per week; sheep and pigs, one farthing per week. One man on my farm feeds and entirely attends to 250 pigs. It would require two men on the old straw-bed system. Our pigs are never cramped now. Formerly they used to be; owing to the manure heating under them, and the cold air giving those parts rheumatism. One stout lad, at 3*s.* 6*d.* per week, will feed and attend to 30 bullocks; another attends to 60 growing calves.

There is a very powerful development of the muscles on boards —so much so, that with fattening pigs, not bred on the boards, I have found some of them get capped hocks. It is surprising how quickly you may fatten young pigs on these floors. They find it inconvenient to run about, so divide their time between eating and sleeping,—a most agreeable operation for the account-book. I think the time is coming when farmers will consider the question of how much meat a ton of turnips or hay will make under various circumstances. If so, the turning-out system will be given up. My old-fashioned bailiff admits that, on the turning-out system, two-thirds of my farm would be required to feed my animals. Now they make shift with one-third. If you desire a

good appetite in your animals, turn them out for exercise in the cold. I tried the turning-out system with some calves. On asking the boy how they got on, he replied, 'Oh, sir, they get on properly well now; they come in *so hungry*.' An answer which settled the question in my mind.

The animals are perfectly healthy on these boards. Considering the confinement and heat, this rather surprises me,—especially with the pigs, fed entirely on meal; for the ammonia, or effluvia, from under them, certainly is powerful enough to discolor the paint. The great difficulty, I find, is in getting a proper fixer for the ammonia; to waste which is an act of agricultural insanity. I have used sulphuric acid, ashes, and various matters, with a certain effect. I hope the Irish peat-charcoal will not be too dear. I have a ton coming on trial. After all, I am inclined to think common salt, or the common dried clay, are the best and cheapest fixers; and I have used a great deal. I can buy the salt here for 30*s*. a ton, and when mixed with the manure, it gives us muriate of ammonia and carbonate of soda—most valuable salts.

Another question connected with the boarded system is the fly question. Where you have plenty of food, warmth, and stock, you will have abundance of flies. My bullocks could never lie down in the daytime, owing to their attacks; and, of course, the continued lifting of their feet prevented fattening. By darkening the feeding-houses, I entirely removed this nuisance, and had the gratification of putting my animals in a most profitable state of repose; for if you have ten millions of flies, not one will bite in the dark. I find that some of my friends have long practised this system with their horses. It is essential to the successful house-feeding of bullocks with green crops during summer.

To those who are not prepared to go with me in boarded floors, I would say, by all means, then, have covered homesteads, such as may be seen at the Rev. Mr. Cooke's, of Semer, near Hadleigh, Suffolk; and at Mr. James Beadel's, Broomfield Lodge, near Chelmsford, Essex; and I am quite sure a visit to them will bring home conviction to the most resolute defender of the old and unprofitable open yards.

It is his great quantity of stock that enables the Lothian farmer to compete, at so great a distance, with the south-country farmer; and I believe it is the still greater quantity kept by Mr. M'Culloch, of Auchness, that enabled him to surpass the Lothian farmers. Mr. Lawes has shewn, most indisputably, in his admirable papers in the journals of the Royal Agricultural Society, that we can produce manure cheaper and better by feeding stock than even by purchasing guano. I mean, not feeding on turnips alone, but using the productions of the farm in conjunction with purchased food.

The author, whilst searching for facts to guide him to the most profitable mode of proceeding, met with the accounts of two farms, variously managed, which confirm, by comparison, his impression that on the quantity and management of live stock depends much

of the success in farming. Annexed to his paper was a comparison of Mr. M'Culloch's, Auchness Farm, with a similar one in Suffolk, which afforded some very striking and instructive conclusions.

The Suffolk Farm—of a superior quality, employing an equal capital but less labour than the Auchness Farm—shewed a considerable loss; whilst the latter produced an ample profit. Now, neither Free Trade nor Protection can have anything to do with this comparison. Nor are there any "peculiar advantages" to object with; because, if the Auchness Farm had superior and convenient buildings for stock, the Suffolk land was naturally superior and in previous good cultivation; whilst the Auchness Farm, much of it naturally poor, had to be improved at the tenant's cost. In the Suffolk Farm there was no purchased manure or imported food: on the Auchness Farm £719 were so expended. On the Auchness Farm the amount of meat made was £884, being the produce of ninety-one acres and the purchased food: on the Suffolk Farm only £352 was received for meat, although one hundred and eleven acres were used for that purpose. On the Auchness Farm £1680 worth of corn and potatoes was sold: on the Suffolk Farm the value of the grain crops was only £793.

The explanation of the causes of success and failure was this:—In one case the animals were housed, warmed, ventilated, groomed, their food cooked, and the utmost made of it, chemically and physiologically: in the other, the usual mode of turning out, with its consequent waste and misapplication of food, was adopted. Here was a dependence on the natural production of the soil, unaided by imported food or manure, and, consequently, a minimum production, with almost a maximum expense: there, a constant addition to the productive powers of the soil, with a maximum produce, and consequent diminished per-centage of expense.

Our success as farmers evidently depends, in a great measure, says the author, on making the most of our root and green crops. The great question of the value of a ton of turnips in its meat-making powers can only be solved by the variety of modes in which it is applied to nutrition. The estimate of value by different persons is from 2*s*. 6*d*. to 12*s*. per ton. In Norfolk, where house-feeding with oil-cake is extensively practised, its estimate is about 7*s*., varying, of course, in some degree, according to the price paid for lean stock. In Essex they are frequently purchased for house-feeding at 10*s*. to 12*s*. per ton; whilst for open or field-feeding they only command from 1*s*. to 3*s*. 6*d*., and the manure left. Many instances might be cited where large flocks of sheep have consumed whole fields of turnips, and come from them absolutely leaner than before. Cold, wet, and comfortless, the frozen turnips acted as a purgative, being unaided and uncorrected by dry hay, oil-cake, or warmth and shelter. The value of the turnip crop was here absolutely nothing, and an enormous loss attended its production. The average cost of producing tur-

nips, all charges included, is not less than 10*s*. to 15*s*. per ton;—it is quite that under the old Essex system of five to eight ploughings, although much cheaper plans are adopted in some districts. It should be remembered that, by feeding animals at home with purchased food, in conjunction with home produce, a constant addition is being made to the productive powers of the soil.

The author, in reviewing his own agricultural position, said:—I do not at all complain of the criticism to which I have been subjected. I considered my farm, in its original state, neither creditable nor profitable, and I expended my capital in its improvement. The result of that expenditure was a decided benefit to my fellow-creatures. My agricultural opponents say the money was thrown away—the property not improved—and that I am losing much money by farming. In order to test the correctness of these opinions, I have, under the advice and suggestion of my friends, submitted to a valuation by three eminent surveyors, who have fixed my rent at 36*s*. per acre, adding another 7*s*. per acre for the use of my machinery, &c. Now, as plenty of land, such as mine was in its unimproved state, can be hired for 12*s*. per acre, the fee-simple of my estate is more than trebled in value; leaving out of view altogether the extra expenditure for my own personal convenience. Whether I shall be able, with present prices, to pay a rental of 43*s*. per acre, besides all other charges, as well as a profit on my tenant-capital invested, remains to be proved. My in-coming valuation as a new tenant was effected on the 30th of October, by the same gentlemen who set my rent. On the 30th of next October, and at all similar periods, so long as I continue to farm, my out-going valuation will also take place. The balance sheet will appear in the public prints, either for good or for evil, as the case may be. It will either be an example to follow, or a beacon to avoid. It will be done in honesty and good faith; but it would be premature now to prejudge its results.

The fixing of the rental being *un fait accompli* may be commented upon, and presents an encouraging feature to improving landlords. I have no doubt but the valuers naturally considered that drainage, good roads, open fields, unencumbered by useless fences and trees, deep cultivation, and good manure, all have a material influence on the business of farming; and that, without good and ample buildings, abundance of water, and proper steam machinery, it would be impossible to accommodate and provide for so large a quantity of stock as I deem it necessary to keep.

In conclusion, I commend to your especial regard the noble practice and improvement of agriculture, as beneficial to health, as conducive to longevity and mental repose, and as full of independence; presenting to your mind, through the charming and ever-varying face of nature, the impress of Almighty goodness and wisdom. I commend it, not only on the low ground of individual profit, but in virtue of its employing and feeding the people,—as a means for promoting the moral, social, and political strength of this great and happy nation.

LIST OF REGISTRATIONS EFFECTED UNDER THE ACT FOR PROTECTING NEW AND ORIGINAL DESIGNS FOR ARTICLES OF UTILITY.

1850.

Oct. 28. *Joseph Harvey*, of 41, Westminster-bridge-road, Lambeth, and Heron-court, Richmond, Surrey, for "the Richmond car."

29. *Charles Maschwitz, jun.*, of Birmingham, for a box or case for postage stamps.

29. *David Duthoit and Job Roof*, of Finsbury-pavement, for "the bush tent."

29. *Thomas Parker*, of Kensington, Middlesex, for a knife and fork cleaner.

30. *Charles Rowley*, of Nos. 23 and 24, Newhall-street, Birmingham, 19, Addle-street, City of London, and 31, Bridgewater-place, Manchester, for "the Prince's vest button."

30. *John Smith and Henry Wills Ditchett*, of the firm of Smith & Co., of St. Augustine's-parade, Bristol, carpet and furnishing warehousemen, for an improved blind roller.

31. *Swaine and Adeney*, of 185, Piccadilly, London, whip manufacturers, for Swaine and Adeney's universal whip-socket.

31. *C. A. & F. Ferguson*, of Mast-house, Millwall, Poplar, for an improved gun-carriage, to facilitate the training and working of heavy guns.

31. *Chapman & Son*, of 14, Frith-street, Soho-square, for a moveable button.

31. *Laurie & Marner*, of Oxford-street, carriage-builders, for an invisible carriage-step.

31. *Earl, Smith, & Co.*, of Hallamshire Works, Sheffield, file manufacturers, for "the triple file."

Nov. 1. *William Leschallas*, of Budge-row, City, for "the Pentagon envelope."

1. *Isaac Naylor*, of Burton-street, Burnsley, for an improved alarm-gun.

1. *John Fernihough & Sons*, of Victoria Works, Yew-tree-lane, for an improved double furnace smoke-burning horizontal tube steam-boiler.

2. *William Curtis Hugman*, of 19, Great Ormond-street, Queen-square, London, surgeon, for a portable folding truss.

4. *George Purcy Tye*, of Birmingham, for a hyacinth glass and support.

4. *David Duthoit & Job Roof*, of Finsbury-pavement, London, for "the aerial tent."

5. *Thomas Lambert & Son*, of Short-street, New-cut, Lambeth, for "the economic fountain lamp."

Nov. 5. *Robert & John Garrard*, of Loman-street, Gravel-lane, Southwark, for "the nautical glazed felt hat."

5. *William Edward Jenkins*, of 48, George-street, Euston-square, for an embossing machine for stamping with ink paper or other materials.

6. *Edouard Auguste Gaillard*, of 10, Bedford-street, Strand, for a new travelling-case.

6. *Browning & Rigby*, of the Adelphi Iron Works, Salford, near Manchester, engineers, for a compound cylinder steam-engine.

7. *John Verrinder*, of Lincoln, in the county of Lincoln, for a box table and sofa bedstead.

7. *Jenkins & Ashford*, of Birmingham, for a mattress.

7. *James Tonkin*, of 315, Oxford-street, London, for an improved spring lath.

7. *William Wilson*, of King-street, Manchester, for a hot water cistern for baths, &c.

8. *Thomas Moore Sharp*, of Belfast, for an improved paddle-wheel.

8. *George Horton*, of 18, Thomas-street, Manchester, for a joiner's brace.

9. *George Broughall*, of Union-street, Willenhall, Staffordshire, key stamper, for "George Broughall's improved steam stamp."

11. *C. & J. Clark*, of Street, near Glastonbury, Somerset, for parts of shoes.

12. *Fowler & Fry*, of Temple Gate Implement Factory, Bristol, for an improved cart.

13. *Martin Billing*, of Newhall-street, Birmingham, printer, for a lithographic perforating and registering machine.

14. *Frederic Grosjean*, of 109, Regent-street, London, for "Der Fuszwärmer" (a railway rug or wrapper).

14. *Thomas Foxall Griffiths*, of Birmingham, for a saucepan lid.

14. *Lord, Brothers*, of Canal-street Works, Todmorden, in the county of York, for an improved hook for the weight-hooks of lap and other machines.

15. *Thomas Foxall Griffiths*, of Birmingham, for a candlestick.

15. *Lorant Poirier*, of Bucklersbury, London, for an improved lithographic press for printing circulars and other small forms.

15. *Jeakins & Wolmershausen*, of 11, Curzon-street, Mayfair, London, tailors, &c., for a lady's riding habit.

18. *Waddington & Son*, of 1, Coleman-street, London, umbrella and parasol manufacturers, for "the Etui Bisutile," or parasol and knitting-case.

19. *Thomas Rutter*, of Harborne, for a nail.

19. *Arthur Jerningham*, of Portsmouth, for a letter-clip.

Nov. 19. *John Martindale & Thomas Bowman*, of Globe-road, Mile-end, for the "Poche-au-chapeau."

20. *Joseph Last*, of 38, Haymarket, London, for "the Continental wardrobe portmanteau."

20. *Joseph Walker Smith*, of Birmingham, for a button.

21. *John Allen*, of Clarence-place, Hackney-road, for a rocking horse.

21. *G. H. & G. Nicoll*, of Dundee, ironmongers, for a portable family mangle.

21. *W. & C. Middleton*, of 40, Long Acre, Coach-builders, for a centripetal wheel-plate.

21. *Francis Cranmer Penrose*, of 4, Trafalgar-square, London, architect, for "the heliograph or logarithmic spiral compass."

22. *George Smith*, of Castle-street, Liverpool, for a waistcoat, having a buoyant lining.

22. *Deane, Dray, & Deane*, of King William-street, London-bridge, for an improved stove.

23. *Charles Boardman*, of 54, Pond-street, Sheffield, in the county of York, for a cover for cruet or spirit frame.

23. *Ross & Sons*, of 119 and 120, Bishopsgate-street, London, for a shield for a comb.

25. *Burgess & Key*, of 103, Newgate-street, for a grater.

25. *William Riddle*, of East Temple Chambers, Whitefriars, London, for a latch and bolt union.

27. *William Stidolph*, of 2, New Bond-street, Bath, for "the chiragon," for teaching and enabling the blind to write.

28. *Thomas Dismore & Son*, of 11, Clerkenwell-green, London, for a spring bolt.

28. *William Southam*, of Church-street, Nuneaton, for an improved self-acting millstone ventilator.

28. *Joseph James Galt*, of Portsmouth, naval outfitter, for a cape.

28. *Lincoln & Bennett*, of Sackville-street, Piccadilly, for a ventilating hunting cap.

29. *Solomon Solomon*, of 14, Commercial-place, City-road, for a marine balance timekeeper.

29. *Jacob Parker*, of 12, Montpelier Avenue, Cheltenham, for a lady's railway portmanteau.

29. *J. H. Cutler*, of Birmingham, for a button.

29. *R. & H. Williams*, of Ludgate-hill, for a self-opening parasol.

30. *J. Whitehead*, of Orchard-street, Charlestown, near Manchester, for a valve box and valves, for the supply pipes of steam-engines.

30. *T. Oldham*, of 50, Cannon-street, Manchester, for a shirt.

Dec. 2. *John Baily*, of Mount-street, Grosvenor-square, for "the pheasant, poultry, and cattle fountain."

2. *P. Rigby*, of Grove-street, Liverpool, for apparatus for burning spirits, for the purpose of obtaining heat for portable cooking apparatus.

2. *A. Clayton*, of Lymington, gun-maker, for a tube for Colonel Hawker's new ignition.

3. *George Twigg*, of Powell-street, Birmingham, for a dress fastener.

3. *T. Oldham*, of Cannon-street, Manchester, for a shirt front.

3. *Hargrave, Harrison, & Co.*, of Wood-street, Cheapside, for a parasol.

5. *J. W. M. Last*, of Devereux-court, Strand, for an improved printing machine.

6. *Charles Warner*, of Birmingham, for a pen-holder.

6. *William Langford*, of Hitchin, for a gas stove.

6. *Richard Batt & Sons*, of Edward-street, Portman-square, for "the versicolor trousers."

9. *William Marshall*, of Regent-street, for a shirt.

9. *George Barnett*, of Jewin-street, Aldersgate, for "the magical cylinder strop."

9. *Ransomes & May*, of Ipswich, for parts of a water crane, for railways.

10. *E. R. Turner & Co.*, of St. Peter's Foundry, Ipswich, for an improved roller mill.

11. *George Turton*, of Wolverhampton, for a flooring cramp.

11. *Walker Brothers*, of White-lion-street, Spital-square, for "the Utrolibet carriage."

11. *Francis Cranmer Penrose & George Forrester Bennett*, of Trafalgar-square, London, for "the sliding helicograph."

13. *R. & J. Rankin*, of Union Foundry, Liverpool, for parts of machinery for cleansing grain or seeds.

13. *Abraham Dimoline*, of Denmark-street, Bristol, for compensation piano-forte mechanism.

14. *Luke Brierley*, of Hurst-street, Birmingham, & *T. Beech*, of Shelton, Staffordshire, for a vertical revolving disc signal lamp.

16. *T. De la Rue & Co.*, of Bunhill-row, for edges of envelopes.

17. *George Twigg*, of Powell-street, Birmingham, for a slide for dress pin.

18. *J. Smith*, of the Iron Works, Uxbridge, for a feed-regulator for mills.

19. *Dent, Allcroft, & Co.*, of Wood-street, Cheapside, for a glove-fastener.

20. *Capper & Son*, of Gracechurch-street, for a folding bassinette or cradle.

Dec. 20. *A. Holden*, of Suffolk-street, Birmingham, for "H. A. Holden's improved tricolor signal lamp with revolving light."

21. *Robinson & Co.*, of Mount-street, Grosvenor-square, for a new carriage lock or wheel-plate.

21. *George Bolton*, of Great Dover-street, for a dress or shawl-fastener.

21. *Dobson & Metcalfe*, of Bolton-le-Moors, for coupling for sheet-metal rollers.

21. *Westley Richards*, of Birmingham, for a guard for carving fork.

21. *Cottam & Hallen*, of 76, Oxford-street, for improved fitting for stables.

21. *G. Bolton*, of the Dover-road, for a dress or shawl-fastener.

21. *E. Shirwood*, of Birmingham, for a show-box for jewellery, &c.

21. *D. S. Brown*, of the Old Kent-road, for "the universal barometer."

26. *John Whitehouse & Son*, of 87, Birchall-street, Birmingham, for roller-blind furniture.

27. *The Hon. William Edward Fitzmaurice*, of Princes-gate, Hyde-park, for a metallic cloth and towel-horse.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th November to the 17th December, 1850, inclusive.

To Christopher Cross, of Farnworth, near Bolton, in the county of Lancaster, cotton-spinner and manufacturer, for certain improvements in the manufacture of textile fabrics; also in the manufacture of wearing apparel and other articles from textile materials; and in the machinery or apparatus for effecting the same.—Sealed 21st November.

William Radley, chemical engineer, and Frederick Meyer, oil-merchant, both of Lambeth, in the county of Surrey, for improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies; in the manufacture and application of them, and of their compounds and subsidiary products; together with the apparatus to be employed therein to new and other useful purposes.—Sealed 7th December.

Peter Armand Le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in oscillating engines,—being a foreign communication.—Sealed 7th December.

Lucien Vidie, of Rue du Grand Chantier, Paris, in the Republic of France, French Advocate, for certain improvements in measuring the pressure of air, steam, gas, and liquids.—Sealed 14th December.

Francis Edward Colegrave, of Brighton, in the county of Sussex, Esq., for improvements in the valves of steam and other engines; in causing the driving-wheels of locomotive engines to bite the rails; and also in supplying water to steam-boilers.—Sealed 14th December.

List of Patents

Granted for SCOTLAND, subsequent to November 22nd, 1850.

To Jules Le Bastier, of Paris, for certain improvements in machinery or apparatus for printing.—Sealed 27th November.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for improvements in the preparation and manufacture of caoutchouc or India-rubber, —being a communication.—Sealed 27th November.

Isaac Lewis Pulvermacher, of Vienna, engineer, for improvements in galvanic batteries, in electric telegraphs, and in electro-magnetic and magneto-electric machines.—Sealed 28th November.

Guillaume Ferdinand de Douhet, of Clermont Ferrand, France, for certain improvements in the disoxygenation and the mutual re-oxygenation of certain bodies, and the application of the products therefrom, either separately or simultaneously employed, to various useful purposes.—Sealed 28th November.

George Benjamin Thorneycroft, of Wolverhampton, iron-master, for improvements in the manufacture of crank axles.—Sealed 2nd December.

David Napier and James Murdoch Napier, of the York-road, Lambeth, London, engineers, for improvements in apparatus for separating fluid from other matter.—Sealed 2nd December.

David Auld, of Glasgow, engineer, for certain improvements in steam-engines, and in the working of steam-boilers or generators, and in apparatus connected therewith.—Sealed 2nd December.

Jean Aime Marnas, of Lyons, France, for improvements in the manufacture of indigo,—being a communication,—Sealed 2nd December.

Peter Wood, of the firm of Thomas Bury & Co., dyers, Adelphi Works, Salford, for improvements in figuring and ornamenting fabrics and paper, and in machinery employed therein.—Sealed 4th December.

William Melville, of Roebank Works, Lochwinnoch, Renfrewshire, for certain improvements in weaving, and manufacturing, and printing carpets and other fabrics.—Sealed 6th December.

Peter Armand Le Comte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in oscillating engines, —being a communication.—Sealed 7th December.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for an improved composition—applicable to the coating of wood, metals, plaster, and other substances which are required to be preserved from decay; which composition may be also employed as a pigment or paint,—being a communication.—Sealed 9th December.

Thomas Deakin, of Balsall Heath, in the county of Worcester, for certain improvements in rolling metals, and in the manufacture of metal tubes; also in apparatus and machinery in connection therewith.—Sealed 11th December.

John George Taylor, of London, merchant, for certain improvements in dress and other pins, and in other dress fastenings and ornaments.—Sealed 11th December.

Robert Olddiss Bancks, of the firm of Bancks Brothers, of Weir-house Mill, Chesham, in the county of Bucks, and 20, Piccadilly, London, paper-makers and card-makers, for improvements in the manufacture of paper.—Sealed 13th December.

George Edward Dering, of Lockleys, in the county of Herts, Esq., for improvements in the means of and apparatus for communicating intelligence by electricity.—Sealed 17th December.

Charles Hanson, of Stepney, London, engineer, and Charles Saunderson, of London, for certain improvements in steam-engines, steam-boilers, and safety-valves, and in apparatus and machinery for propelling vessels —Sealed 18th December.

John Ransom St. John, of the City of New York, engineer, for improvements in the construction of compasses and apparatus for ascertaining and registering the velocity of ships or vessels through the water.—Sealed 18th December.

James Mather the younger, of Crow Oaks, Pilkington, in the county of Lancaster, bleacher, and Thomas Edmeston, of the same place, for certain improvements in machinery or apparatus for scouring, finishing, and stretching woollen, cotton, and other woven fabrics.—Sealed 20th December.

Edward Dunn, of New York, but now residing at the London Coffee House, Ludgate-hill, London, master mariner, for an improved engine for producing motive power by the dilation or expansion of certain fluids or gases, by the application of caloric.—Sealed 20th December.

New Patents
SEALED IN ENGLAND.
1850.

To Henry Duncan Preston Cunningham, of Bury, in the county of Hants, Paymaster and Purser in the Royal Navy, for improvements in reefing sails. Sealed 30th November—6 months for inrolment.

Frederick Buonapart Anderson, of Gravesend, in the county of Kent, optician, for certain improvements in spectacles. Sealed 30th November—6 months for inrolment.

Robert Olddiss Bancks, of the firm of Bancks Brothers, of Weir-house Mill, Chesham, in the county of Bucks, and 20, Piccadilly, London, paper-makers and card-makers, for improvements in the manufacture of paper. Sealed 30th November—6 months for inrolment.

Francis Frederick Woods, of Pelham-terrace, Brompton, in the county of Middlesex, builder, for improvements in paving. Sealed 30th November—6 months for inrolment.

John Ainslie, late of Alperton, in the county of Middlesex, now residing at Perry-hill, Sydenham, in the county of Kent, draining engineer, for certain improvements and apparatus for the manufacture of bricks, tiles, and other articles made from clay and other plastic substances; parts of the said arrangements and apparatus being applicable to the treatment and preparation of earths, minerals, animal, and vegetable matters. Sealed 30th November—6 months for inrolment.

James Augustus Elmslie, and George Simpson, of Union-buildings, Leather-lane, Holborn, importers of quicksilver and tin-foil manufacturers, for improvements in sheathing ships, and in protecting and confining gunpowder, and certain compounds thereof, and in the materials used for such purposes. Sealed 30th November—6 months for inrolment.

Henry Potter Burt, of the Blackfriars-road, in the county of Surrey, civil engineer, for improvements in the manufacture of window-blinds. Sealed 30th November—6 months for inrolment.

William Henry Ritchie, of Kennington, in the county of Surrey, Gent., for improvements in stoves,—being a communication. Sealed 30th November—6 months for inrolment.

Joseph Eugene Chabert, of Paris, in the Republic of France, for improvements in machinery for washing and drying linen and other fabrics. Sealed 30th November—6 months for inrolment.

Richard Barber, of Hotel-street, Leicester, late cotton-winder, for improvements in the manufacture of reels for reeling, and stands for reels; which improvements are applicable to the manufacture of desk or wafer-seals. Sealed 30th November—6 months for inrolment.

Henry Jules Borie, of Boulevard Poissonniere, in the Republic of France, engineer, for improvements in the manufacture of bricks. Sealed 30th November—6 months for inrolment.

Charles Rowley, of Birmingham, manufacturer, for improvements in the manufacture of dress-pins and other dress fastenings and ornaments. Sealed 30th November—6 months for inrolment.

Richard Blakemore, of The Leys, in the parish of Ganerew, in the county of Hereford, Esq., M.P., for improvements in the construction of ploughs. Sealed 30th November—6 months for inrolment.

John Platt, of Oldham, in the county of Lancaster, engineer, for certain improvements in machinery or apparatus for spinning and doubling cotton, and weaving cotton, flax, and other fibrous substances. Sealed 2nd December—6 months for inrolment.

Thomas Watson, of Rochdale, in the county of Lancaster, hat manufacturer, for improvements in the manufacture of hat-plush, and also in machinery or apparatus employed in such manufacture. Sealed 2nd December—6 months for inrolment.

Richard Shiers, of Oldham, in the county of Lancaster, manufacturer, and James Heginbottom, of the same place, manager, for improvements in the manufacture of textile fabrics. Sealed 2nd December—6 months for inrolment.

Julian Bernard, of Green-street, Grosvernor-square, Gent., and Jean Baptiste Dureuille, of 30, Cité de l'Etoile, Thermes, in the Republic of France, for improvements in the manufacture or production of boots and shoes, and in the materials and machinery or apparatus to be employed therein. Sealed 4th December—6 months for inrolment.

Benjamin Hinley, of Birmingham, brass-founder, for improvements in the manufacture of castors. Sealed 5th December—6 months for inrolment.

Joseph Alexander Franklinsky, of Stanhope-place, iu the county of Middlesex, Gent., for improvements in public carriages for the conveyance of passengers. Sealed 5th December—6 months for inrolment.

Ewald Riepe, of Finsbury-square, in the City of London, merchant, for certain improvements in refining steel. Sealed 5th December—6 months for inrolment.

Henry Walker Wood, of Briton Ferry, near Neath, Glamorganshire, Gent., for improvements in the manufacture of fuel. Sealed 7th December—6 months for inrolment.

Samuel Rayner, of Berners-street, Oxford-street, in the county of Middlesex, artist, for improvements in paving. Sealed 7th December—6 months for inrolment.

Archibald Turner, of Leicester, manufacturer, for improvements in applying heat for generating steam for motive power, and for other purposes; and in generating heat, and in heating and evaporating fluids. Sealed 7th December—6 months for inrolment.

James Thomson Wilson, of Stratford-le-Bow, in the county of Middlesex, chemist, for improvements in the manufacture of alum, and in obtaining ammonia. Sealed 7th December—6 months for inrolment.

Francis Papps, of Camberwell, chemist, for improvements in me-

tallic and other bedsteads, mattresses, and curtain-rods; and in the coating or covering of bedsteads and other articles, wholly or in part composed of metal. Sealed 7th December—6 months for inrolment.

Alexander Mein, of Glasgow, accountant, for certain improvements in treating the fleeces of sheep when on the animals,—being a communication. Sealed 7th December—6 months for inrolment.

John Mortimer, of Hanover-square, in the county of Middlesex, Esq., for improvements in the magnetic needle and mariner's compasses. Sealed 7th December—6 months for inrolment.

George Henry Voyez, of Acton-street, in the county of Middlesex, artist, for improvements in the manufacture of paper-hangings. Sealed 7th December—6 months for inrolment.

James Ward Hoby, of Glasgow, engineer, for improvements in the construction of the permanent way of railways. Sealed 7th December—6 months for inrolment.

John Everest, of Tonbridge, in the county of Kent, and George Osborne, of the same place, for certain improvements in commodes, and in fixed and portable water-closets. Sealed 7th December—6 months for inrolment.

David Lloyd Williams, of Thornhill, Llandilo, in the county of Carmarthen, Gent., for certain improvements in furnaces. Sealed 7th December—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in engines to be worked by steam or other power,—being a communication. Sealed 7th December—6 months for inrolment.

Richard Archibald Brooman, of Fleet-street, in the City of London, for improvements in agricultural machines,—being a communication. Sealed 7th December—6 months for inrolment.

Peter Wood, of the firm of Thomas Bury and Co., dyers, calenderers, and finishers, Adelphi Works, Salford, in the county of Lancaster, for improvements in figuring and ornamenting woven fabrics, and in machinery employed therein. Sealed 11th December—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in cutting and dressing stone,—being a communication. Sealed 12th December—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the manufacture of iron hurdles or fences, and of certain other articles, in the construction of which wire-work is or may be employed,—being a communication. Sealed 12th December—6 months for inrolment.

William Beckett Johnson, of Manchester, in the county of Lancaster, manager, for certain improvements in steam-engines,

and in apparatus for generating steam; such improvements in engines being wholly or in part applicable where other vapours or gases are used as the motive power. Sealed 12th December —6 months for inrolment.

John Mason, of Rochdale, in the county of Lancaster, machine-maker, and George Collier, of Halifax, in the county of York, manager, for certain improvements in preparing cotton and other textile materials for spinning; and in tools or apparatus for making cards and other parts of such preparing machinery; and in engines for giving motion to the same; which engines are also applicable in other cases where motive power is required. Sealed 12th December—6 months for inrolment.

Samuel Baxter, of Wapping, in the county of Middlesex, shipwright, for improvements in apparatus for lifting and for facilitating the working or steering of ships. Sealed 12th December —6 months for inrolment.

Thomas Hoskins Howels, of Amelia-row, Landport, Portsea, in the county of Hants, gunner, for improvements in gun-carriages. Sealed 12th December—6 months for inrolment.

Joseph Bunnett, of Deptford, in the county of Kent, engineer, for certain improvements in doors, windows, shutters, and blinds. Sealed 12 December—6 months for inrolment.

Edmund Morewood, of Enfield, in the county of Middlesex, Gent., and George Rogers, of the same place, Gent., for improvements in coating or covering metals. Sealed 12th December—6 months for inrolment.

Jean Aime Marnas, of Lyons, for improvements in the manufacture of indigo,—being a communication. Sealed 12th December—6 months for inrolment.

Joseph Baldwin and George Collier, both of Halifax, mechanics, for improvements in the manufacture of carpets and other fabrics. Sealed 12th December—6 months for inrolment.

George Royce, of Fletland, in the county of Lincoln, miller, for improvements in grinding, dressing, and cleaning corn and seed. Sealed 12th December—6 months for inrolment.

George Benjamin Thorneycroft, of Wolverhampton, iron-master, for improvements in the manufacture of crank axles. Sealed 12th December—6 months for inrolment.

Richard Rodham, of Gateshead, in the county of Durham, practical chemist, and Edward Robert Hoblyn, of Stepney, in the county of Middlesex, Gent., for improvements in machinery and apparatus for condensing and purifying smoke gases and other noxious vapours arising from fire-places and furnaces, or from chemical and other works; and in rendering the products resulting from such condensation and purification available for the manufacture of various colors. Sealed 16th December—6 months for inrolment.

Edward D'Orville, of Manchester, merchant, and John Partington, of Wicken Hall, near Rochdale, in the same county, bleacher,

for certain improvements in finishing thread or yarn. Sealed 19th December—6 months for inrolment.

Goorge Henry Bachhoffuer, of Grove-road, St. John's Wood, in the county of Middlesex, and Nathan Defries, of Grafton-street, Fitzroy-square, in the same county, civil engineer, for improvements in obtaining light and heat, and in apparatus connected therewith. Sealed 19th December—6 months for inrolment.

John George Taylor, of Great St. Thomas Apostle, in the City of London, merchant, for improvements in the manufacture of dress and other pins, and other dress fastenings and ornaments. Sealed 19th December—6 months for inrolment.

Philip Nind, of Leicester-square, Gent., for improvements in the manufacture of sugar, and in cutting and rasping vegetable substances,—being a communication. Sealed 19th December —6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, for improvements in the manufacture of files,—being a communication. Sealed 19th December—6 months for inrolment.

Sebastiano Botturi, of No. 7, Place de la Bourse, Paris, civil engineer, for certain improvements in machinery and apparatus for elevating fluids, and in their application as a motive power. Sealed 19th December—6 months for inrolment.

David Auld, of the City of Glasgow, North Britain, engineer, for certain improvements in steam-engines and in the working of steam-boilers or generators, and in apparatus connected therewith. Sealed 19th December—6 months for inrolment.

William Henry Green, of No. 8, Basinghall-street, in the City of London, Gent., for improvements in the preparation of peat and other ligneous and carbonaceous substances, and in the conversion of some of the products derived thereby, and in the mode of their application to the preservation of substances liable to decomposition and destructive agencies; and which mode is also applicable to other products of a similar nature. Sealed 19th December—6 months for inrolment.

Henry Mortlock Ommanney, of the City of Chester, Esq., for certain improvements in the manufacture of steel. Sealed 19th December—6 months for inrolment.

Adolphus Oliver Harris, of High Holborn, in the county of Middlesex, philosophical instrument-maker, for improvements in barometers,—being a communication. Sealed 19th December —6 months for inrolment.

John Henry Pape, of Paris, for improvements in musical instruments. Sealed 20th December—6 months for inrolment.

William Herbert Gossage, of Stoke Prior, in the county of Worcester, chemist, for improvements in the construction of sulphuric acid and certain other fluids; also in the use of a certain product or certain products sometimes obtained in manufacturing sulphuric acid and sulphates. Sealed 20th December—6 months for inrolment.

Edward Dunn, of New York, but now residing at the London Coffee-house, Ludgate-hill, in the City of London, master mariner, for an improved engine for producing motive power by the dilatation or expansion of certain fluids or gases, caused by the application of caloric. Sealed 26th December—6 months for inrolment.

William Hodgson Gratrix, of Salford, in the county of Lancaster, engineer, for certain improvements in the method of producing or manufacturing velvets or other piled fabrics. Sealed 26th December—6 months for inrolment.

George Edward Dering, of Lockleys, in the county of Herts, Esq., for improvements in the means of, and apparatus for, communicating intelligence by electricity. Sealed 27th December—6 months for inrolment.

John Mathison Fraser, of Mark-lane, in the City of London, merchant, for improvements in the manufacture of sugar,—being a communication. Sealed 27th December—6 months for inrolment.

John Ransom St. John, of the City of New York, in the United States of America, engineer, for improvements in the construction of compasses and apparatus for ascertaining and registering the velocity of ships or vessels through the water. Sealed 27th December—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the construction of metal shutters,—being a communication. Sealed 27th December—6 months for inrolment.

Celeste Menontti, of No. 6, Rue de la Paix, Paris, Gent., for certain chemical compositions for rendering cotton, linen, woollen, silk, and other fabrics, impervious to water; and fixing colors in dyeing. Sealed 27th December—6 months for inrolment.

William Henry Jones, M.A., of Queen's College, Oxford, and of Chorley, in the county of Sussex, clerk, for improvements in apparatus to be used when burning candles. Sealed 28th December—6 months for inrolment.

Thomas Symes Prideaux, of Southampton, Gent., for improvements in generating and condensing steam, and in fire-places and furnaces. Sealed 28th December—6 months for inrolment.

James Slater and John Nuttall Slater, of Dunscar, near Bolton, in the county of Lancaster, bleachers, for certain improvements in machinery or apparatus for the purpose of stretching and opening textile or woven fabrics. Sealed 28th December—6 months for inrolment.

CELESTIAL PHENOMENA FOR JANUARY, 1851.

D.	H.	M.	
1			Clock before the ☉ 3m. 44s.
—			☽ rises 7h. 0m. M.
—			☽ passes mer. 11h. 16m. M.
—			☽ sets 3h. 27m. A.
	3	11	♂ in conj. with the ☽ diff. of dec. 3. 37. S.
2	10	44	Ecliptic conj. or ● new moon
3	16	46	☿ in conj. with the ☽ diff. of dec. 1. 35. S.
4	15	36	♅ stationary.
	20	25	♄ in □ with the ☉
5			Clock before the ☉ 6m. 2s.
—			☽ rises 10h. 20m. M.
—			☽ passes mer. 3h. 15m. A.
—			☽ sets 8h. 17m. A.
	8	0	♀ stationary
	16	0	☽ in Apogee
6	1	19	☿ greatest elong. 19. 9. E.
8	5	0	♃'s first sat. will im.
9	15	47	☿ in the ascending node
	16	11	♄ in conj. with the ☽ diff. of dec. 2. 37. N.
10			Clock before the ☉ 7m. 44s.
—			☽ rises 11h. 46m. M.
—			☽ passes mer. 6h. 6m. A.
—			☽ sets Morn.
	4	21	☽ in □ or first quarter
	13	24	♅ in conj. with the ☽ diff. of dec. 4. 59. N.
11			Occul. x^2 Ceti, im. 10h. 34m. em. 11h. 34m.
	2	0	♃'s second sat. will im.
12	6	2	♃ in □ with the ☉
	12	26	☿ stationary
	20	0	♀ in Perihelion
13	12	0	♃ in Aphelion.
14	5	24	☿ in Perihelion
15			Occul. X^3 Orionis, im. 5h. 38m. em. 6h. 35m.
—			Clock before the ☉ 9m. 38s.
—			☽ rises 2h. 19m. A.
—			☽ passes mer. 10h. 24m. A.
—			☽ sets 5h. 25m. M.
—			Occul. 68, Orionis, im. 9h. 40m. em. 10h. 49m.
	6	53	♃'s first sat will im.
16	14	58	♅ in □ with the ☉
17			Partial eclipse of the ☽
—			Begins 2h. 29·9m.
—			Middle 4h. 50m.
—			Ends 7h. 10·1m.
—			Occul. d^1 Cancri, im. 11h. 10m. em. 12h. 13m.
—			Occul. θ Cancri, im. 15h. 10m. em. 16h. 11m.
	1	21	♃'s first sat. will im.
17	4	42	Ecliptic oppo. or ○ full moon
17			Mercury R. A. 20h. 35m. dec. 16. 23. S.
—			Venus R. A. 17h. 15m. dec. 17. 35. S.
—			Mars R. A. 18h. 59m. dec. 23. 34. S.
—			Vesta, R. A., 15h. 37m. dec. 13. 17. S.
—			Juno, R. A., 16h. 45m. dec. 12. 0. S.
—			Pallas, R. A., 22h. 31m. dec. 6. 48. S.
—			Ceres R. A. 0h. 33m. dec. 5. 27. S.
—			Jupiter R. A. 13h. 24m. dec. 7. 27. S.
—			Saturn R. A. 0h. 59m. dec. 3. 39. N.
—			Uranus R. A. 1h. 39m. dec. 9. 43. N.
—			Mercury passes mer. 0h. 50m.
—			Venus passes mer. 21h. 28m.
—			Mars passes mer. 23h. 13m.
—			Jupiter passes mer. 17h. 36m.
—			Saturn passes mer. 5h. 13m.
—			Uranus passes mer. 5h. 52m.
18			Occul. Ψ Leonis, im. 19h. 38m. em. 20h. 30m.
	2	0	☽ in Perigee
	4	33	♃'s second sat. will im.
20			Clock before the ☉ 11m. 16s.
—			☽ rises 8h. 26m. A.
—			☽ passes mer. 2h. 29m. M.
—			☽ sets 9h. 41m. M.
	17	35	♀ at greatest brilliancy
21	21	15	☿ in inf. conj. with the ☉
22	21	59	♃ in conj. with the ☽ diff. of dec. 4. 3. S.
24	3	15	♃'s first. sat. will im.
	8	17	☽ in □ or last quarter
25			Clock before the ☉ 12m. 34s.
—			☽ rises 1h. 34m. M.
—			☽ passes mer. 6h. 45m. M.
—			☽ sets 11h. 48m. M.
—			Occul. 49, Libra, im. 17h. 42m. em. 18h. 57m.
27	20	56	♀ in conj. with the ☽ diff. of dec. 1. 44. N.
29	14	46	☿ in conj. with ♂ diff. of dec. 4. 16. N.
30	4	29	☿ in conj. with the ☽ diff. of dec. 2. 8. N.
	6	3	♂ in conj. with the ☽ diff. of dec. 2. 0. S.
31			☉ eclipsed, invis. at Greenwich

J. LEWTHWAITE, Rotherhithe.

THE

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No. CCXXX.

RECENT PATENTS.

To James Ashworth, *of Rochdale, in the county of Lancaster, woollen manufacturer, and* Thomas Mitchell, *of the same place, manager, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, wool, and other fibrous materials.*—[Sealed 29th May, 1850.]

The first head of this invention relates to those machines commonly known, in preparing and spinning, as "billys," "jacks," and "hand-mules," and consists in a novel arrangement of catch for detaining the carriage in a fixed position, when run out;—such arrangement consisting in the employment of a spring-catch, having a hook-shaped recess formed therein.

The second head relates to looms for weaving cotton, wool, and other fibrous materials, and consists, firstly, in a method of detecting the breakage or undue absence of the weft-thread;—the peculiar feature of such method consisting in the employment of an apparatus which would, according to its unimpeded action, stop the working of the loom at each motion; but which is prevented from so operating, when the weft-thread is correctly present, by a wire or finger arriving into such a position that, as the said thread is being thrown by the shuttle, it shall loop upon it; and, by thus acting upon the said wire or finger, so dispose the apparatus as to allow of the continued working of the loom. Secondly, in a method of regulating the insertion of any required number of picks of

weft-thread to a given length of woven fabric;—the essential character of this part of the invention being the rendering available the differential motion arising from a connection of the yarn or the cloth with any suitable working part of the machine, which moves in accordance with the number of picks; for the purpose of regulating the quantity of yarn given off, or, inversely, of cloth wound on. Thirdly, in a method of causing the loom to stop at any particular position of its parts, or at any time after the breakage of the weft-thread, that may be required: this is accomplished by causing any suitable apparatus used for stopping looms—as, for instance, "weft or warp-detectors," or hand-gear,—to bring an intermediate apparatus into such a position that it may be acted upon (so as to effect the required stopping) by tappets, or other such instruments, which receive motion from any working part of the machine. Fourthly, in the application of a catch to any convenient part of the stop-motion; which, being thereby brought into connection with a spring, or other projection, attached to the slay, arrests the motion thereof when required.

The first head of the invention is shewn at fig. 1, in Plate IV., as applied to a hand-mule; and fig. 1*, shews the improved catch in plan view. The carriage is shewn at *a, a,* and the shaft of the faller-wire at *b.* Upon this shaft is mounted a projecting arm *c,* to which is connected, by means of a joint, the upper end of a rod *d,* passing through a guide *e.* To the stationary framework of the machine is jointed one end of a catch *f,* which is pressed inwards by means of a spring *g,* but prevented from turning beyond a certain position by a pin placed in a staple *h,* through which the catch *f,* projects. Whenever the carriage is run in, the rod *d,* will arrive in contact with the inclined part of the catch *f,* and, forcing it out, will fall into the notch formed therein, as shewn in the drawing. Upon the faller-wire being depressed, the rod *d,* will, by the connection described, be raised from the catch, and the operation of running up may be performed. This part of the invention applies also, as before stated, to billys and jacks, and its application will be readily understood from the example given. It will be evident also that, if desired, the catch may be affixed to the carriage, and the rod remain stationary.

The first part of the second head of the invention is shewn at figs. 2, 3, and 4;—fig. 2, being a plan or horizontal view of part of a woollen loom, with the improved weft-detector applied; fig. 3, a cross section thereof; and fig. 4, a detached view of certain of the parts, looking towards the right-hand

end of fig. 3. Upon the tappet-shaft of the machine is mounted a grooved cam A, A; within which is placed a bowl or roller, mounted upon the end of a lever B, B: this lever turns upon a fixed centre at C, and is provided, at its other end, with a slot, within which is a pin, projecting from another lever D, affixed to a shaft E. To this shaft is attached one end of a lever F,—the other end thereof being connected to a rod G, which is jointed at top to an arm H, which turns loosely upon a shaft I. To the rod G, is affixed a frame J, J, the upper part of which carries a cross-shaft K, capable of vibrating on its centre; and to this shaft is affixed a bent piece of metal L, and also a wire or finger M. The shaft I, carries an arm N, wherein a peculiarly-shaped groove O, is formed, as will be seen by reference to fig 4. Upon the shuttle-box is affixed a projecting wire Q, which is for the purpose of bearing the weft-thread upward as it passes towards the web. The operation of this apparatus is as follows:—According to the position, shewn in the drawing, of the various parts, the picking motion has taken place, and the shuttle is partly across the web; at which time the cam A, through the intervention of the levers B, D, F, and connecting-rod G, will have brought down the arm H, and with it the frame J, so as to have caused the wire or finger M, to intercept the weft-thread, which has thereby been caused to loop on it, as shewn at fig. 2; at the same time carrying the bent piece L, into the slot O,—the weft-thread being prevented from sinking below the action of the finger M, by means of the wire Q. The continued revolution of the cam will now reverse the motion of the frame J, and cause it to ascend and bear with it the bent piece L; which, by the tension of the weft-thread upon the finger M, is kept against the outside edge of the groove O, so as to avoid a notch P, formed in the arm N;—the finger or wire M, being sufficiently long to keep the weft-thread looped thereon, until the bent piece L, shall have risen above the groove O. The motion will thus continue as long as the weft-thread leaves that side of the loom in its proper connection with the web; but if it should be broken, or otherwise absent from its due position, then the finger or wire M, not being held forward by the before-mentioned tension, will allow the bent piece L, to fall back; so that, upon its ascending motion, it will arrive in contact with the notch P, and, by a continuance of such movement, force the arm N, upward; whereby the rod I, will be made to rock upon its centre, and, through the intervention of the means hereafter described, under another

part of the invention (or of any ordinary arrangement), shift the driving-strap of the loom on to the loose pulley.

The second part of this head of the invention will be understood from the following description:—Fig. 5, is an end view of a cotton loom, with the improvements applied thereto; fig. 6, is a back view thereof; and fig. 7, is a detached view of one form of apparatus for obtaining the motion which constitutes the principle of this part of the invention. The patentees, in the first place, describe this separately, and, subsequently, its application to the purpose of regulating the delivery of the yarn, or the taking up of the cloth. *a, a,* represents a fixed stud, upon which is mounted, loosely, a spur pinion *b*; to the boss of which is attached a bevil-pinion *c*, taking into another *d*, which is capable of turning loosely upon a short shaft *e*. This shaft is provided, at one end, with a collar *f*, mounted loosely upon the stud *a, a*; and the bevil-pinion *d*, is in gear with a similar pinion *g*, also mounted loosely upon the stud *a*. Now, suppose rotation to be communicated to the pinion *b*, and, consequently, to the bevil-pinion *c*, by a connection with the motion of the warp, as it is drawn off; and suppose also that the pinion *g*, is caused to rotate, by reason of a connection with the crank-shaft, or other suitable moving part of the loom;—it is evident, that if these two driving media operate so as to cause the pinions *c*, and *g*, to revolve at an equal rate, the several wheels described will operate after the manner of an ordinary train; and the connections are so calculated as to cause this condition to be observed when the correct number of picks are afforded to a given length of warp. But, suppose that the warp-beam (to which rotary motion is given), owing to its decreasing diameter, would afford a diminished quantity of yarn,—then the pinion *c*, having a reduced rotation imparted to it, will revolve at a slower rate than the pinion *g*: the consequence of this difference will be a diminished action upon the teeth of the pinion *d*, although the same action is exerted thereon by the pinion *g*. This would be an impossible condition if the train were mounted in an ordinary manner; but, as the shaft *e*, turns loosely upon the fixed stud *a*, the pinion *d*, will be caused to roll upwards, in order to compensate for the greater speed imparted at one side thereof. In like manner, should the pinion *c*, exceed in velocity the pinion *g*, the connecting one *d*, will be caused to roll downwards; by which motion the shaft *e*, will be caused to rise or fall as the revolutions fluctuate; and it is from this shaft that the means of regulating the delivery of the yarn or the taking-up of the cloth is obtained.

The practical application of this plan will be understood from the following description thereof:—The warp-beam of the loom is shewn at *h*; the yarn, after leaving this, passes over a roller *i*, which is mounted, so as to turn freely upon centres; and from thence it is conducted over another roller *j*, and then through the loom, as usual. Upon the axle of the roller *i*, is mounted a pinion *k*, which, by means of an intermediate pinion, communicates rotation to the pinion *b*, already mentioned. One motion, described with reference to fig. 7, being thus obtained, the other is effected as follows:—Upon the crank-shaft is affixed a tappet *l*, which, by the rotatory motion of the shaft, is carried round, and brought into contact with one arm of a bell-crank lever *m*, mounted loosely on a centre at *n*;—the other arm thereof being jointed to an upright rod *o*. Upon this rod *o*, is affixed a click *p*, working into the teeth of a ratchet-wheel *q*; upon the inside face of which a pinion *r*, is mounted. This pinion gears into a pinion *s*, which is affixed to the bevil-pinion *g*; and it also gears into a pinion *t*, which has one tooth less in its circumference than that shewn at *s*, and is stationary upon the stud *a*. By this arrangement, as is well understood, the pinion *g*, will be caused to revolve at a greatly diminished rate. Upon the rod *o*, is affixed a tappet *u*, which raises, at intervals, a lever *v*, mounted loosely upon an axle *w*. This lever *v*, carries a click, which takes into the teeth of a ratchet-wheel *x*, keyed to the shaft *w*; upon which is also mounted a worm *y*, taking into a worm-wheel *z*, upon the axle of the warp-beam; by which arrangement the delivery of the yarn is effected.

Upon the axle of the ratchet-wheel *x*, is mounted a pulley *x**, around which a cord is coiled,—one end of the said cord being attached to a stationary part of the machine, and the other end thereof carrying a weight, so as to produce a break and effect a steadiness of action. From the arm *e*, a cord 1, extends downwards,—the lower end thereof being connected to a rod 2, 2*, from which is suspended a weight 3. The rod 2, 2*, is mounted upon a fixed centre 4; and the end 2*, thereof projects under the click-lever *v*; which, after having been raised by the tappet *u*, falls by its own gravity,—the amount of such falling motion being determined by the position of the rod 2*. Affixed to the stud *a*, is an arm 5, and to the end thereof a cord is attached, which, after coiling around a pulley 6, formed upon the boss of the ratchet-wheel *q*, carries a weight 7. The operation of this part of the improvements is as follows:—Upon motion being communicated to the loom,

in the ordinary manner, the tappet *l*, will, by acting upon the lever *m*, cause the rod *o*, to rise, and thus bring the tappet *u*, into contact with the lever *v*, which, by turning upon the shaft *w*, will, through the intervention of its click acting upon the ratchet-wheel *x*, cause the wheel *z*, to revolve, and let off the yarn;—the reciprocating motion of the rod *o*, at the same time, through the click *p*, imparting rotary motion to the ratchet-wheel *q*, and from thence to the pinion *g*. As the warp-beam decreases in size, the same amount of rotation given to it will cause a diminished quantity of yarn to pass therefrom; and, consequently, a lessened revolution will be imparted to the roller *i*, and from thence, through the train of gearing shewn, to the pinion *c*; which retarded motion, acting as before described, will cause the shaft *e*, to rise, and, by means of the cord 1, carry with it the rod 2;—the other end 2*, thereof falling, and thus allowing the lever *v*, to descend lower, and, consequently, provide for an increased action of its click upon the teeth of the ratchet-wheel *x*, so as to turn the warp-beam a greater portion of a revolution at each motion. It will be evident, that the finer the teeth of the ratchet-wheel, the more frequent will be the movements of the warp-roller, and, therefore, the more perfect the density of the fabric; and, for this purpose, two or more clicks may be employed, so as to come into operation by gaining a portion of a tooth at a time. The taking-up and other motions of the loom may be precisely the same as those in ordinary use,—the weights commonly attached to the warp-beam being, however, dispensed with.

In order to prevent the yarn-beam from revolving when it is desired to stop the machine, an apparatus is applied so as to arrest its motion independently of the general stopping of the loom. The construction of this apparatus is thus described:—43, represents the rod of the instrument known as "Kenworthy's weft-detector";—to this rod is applied a lever 45, to which is connected a rod 46, the movement of which is controlled by a guide 47. Upon the weft-detector coming into operation, the rod 43, by turning on its centre, will, through the intervention of the lever 45, thrust forward the rod 46, until it is under a pin 50, which projects from the rod *o*; and, by thus preventing the said rod from falling, will keep the arm *m*, without the range of the wiper *l*, and arrest the motion for giving off the warp, as before described: at the same time, the lever 44, will throw the straining-up catch out of its ratchet-wheel in the ordinary manner. Figs. 8, 9, 10, and 11, shew this part of the invention applied to a woollen-loom,

and in some measure modified as to arrangement. Fig. 8, is an end elevation of the machine; fig. 9, is a partial plan view thereof; and figs. 10, and 11, are detached views of certain parts of the improved apparatus,—the last mentioned being a view looking towards the opposite end of the loom to that shewn at fig. 8. In this instance, instead of taking the motion, for one end of the regulating apparatus, from the motion of the yarn, it is derived from the contact of a roller 8, which revolves upon the woven fabric. This roller is connected to the shaft 9, which it is required to turn, by means of an universal joint, so that it may always maintain a position parallel to the work-beam; and it is mounted in a frame, which is weighted, as shewn at fig. 11, in order to gain sufficient driving power. The wheels *c, d, g,* described in the former figures, are mounted in the same manner upon a shaft of the roller 8, excepting that the wheel *c,* is fast upon the said shaft, upon which, instead of the ratchet-wheel *i,* is affixed a worm-wheel 10, which takes into a worm 11, mounted upon a short shaft 12; and upon this is placed a ratchet-wheel 13, which is driven by a click projecting from a vertical rod 14, connected, at its upper end, to a lever 15, which vibrates on a fixed centre 16. The other end of the lever 15, is acted upon by a cam 17, mounted upon the crank-shaft of the loom; and thus the rod 14, is caused to move up and down, and communicate the required motion to the bevil-pinion *g,* of the former, and also of this arrangement. At the lower part of the rod 14, is affixed a projecting pin 21, which, as the rod 14, rises, arrives in contact with a lever 22, mounted loosely upon the shaft 23, of a ratchet-wheel 24; which wheel is driven by a click projecting from the said lever 22. On the other end of the shaft 23, is a worm, taking into a worm-wheel 25, mounted upon the axis of the warp-beam. The shaft, upon which the pinion *d,* (fig. 7,) that connects the two motions, is mounted, is shewn at *e,* fig. 8; and to it is attached a cord 26, the lower end of which is connected to a lever 27, mounted upon a centre pin at 28, and borne downwards by a weighted cord 29; by which means the lever 27, is caused to rise according to the motion of the shaft *e,* and thus allow the lever 22, a greater extent of motion, and, consequently, an increased action, by means of its click, upon the ratchet-wheel 24.

The operation in effect is precisely similar to that described with reference to figs. 5, 6, and 7; for, as the warp-beam decreases in size, less yarn will be given off, and therefore less length of cloth produced: the consequent decreasing motion

of the work-beam retards the revolution of the roller 8, and that of the pinion *c*, fig. 7. The effect, as before, will be a rising of the shaft *e*, which motion, through the intervention of the connections shewn and described, will allow that end of the lever 22, which carries the driving-click, to fall, so as to cause it to move through a greater space when operated upon by the rod 14, and, by taking an increased number of teeth of the ratchet-wheel 24, cause the warp-beam to give off the required quantity of yarn. In this case, as in the former, the speeds are of course so calculated, that the pinions shall run at the same velocities when the required number of picks are going into a given length of yarn.

Attached to the rod I, (fig. 8,) of the weft-detector apparatus, before described, there is a lever 51, which is provided with a projecting pin 52, placed behind the arm 53, which is mounted loosely on the shaft I. Upon the weft-detector apparatus coming into operation, the shaft I, turning, as before described, upon its centre, will bring the pin 52, against the arm 53, so as to thrust it forward, until a projecting part thereof shall have arrived under a stud 54, which is attached to the upper part of the rod 14, which, as before described, carries the click for giving motion to the warp-beam;—the rod 14, being, by this means, prevented from falling, the yarn will cease to be given off. Reference to fig. 11, will shew the operation which, at the same time, takes place with regard to the work-beam. Upon the shaft I, is affixed a tappet 55, which, as the shaft revolves, is brought to bear against an arm 56, projecting upwards from the "straining-up catch" 57, and throws it out of contact with the teeth of its ratchet-wheel, and causes the taking-up motion to cease.

The patentees remark that, although they have described this part of their invention as applied immediately to the warp-beam, it will be evident that the same effect may be indirectly produced by weighting the warp-beam, as is now practised, and applying the regulated driving apparatus to the work-beam: they also state, that various modes of using the yarn or the cloth, for gaining the required motion, may be adopted. If desired, the warp-beam, instead of being mounted in fixed bearings, may be placed in a spring-bracket, and prevented from giving way too far by means of a stop-piece; while it is allowed to move in a slot, formed therein, so as to afford a certain degree of elasticity to the yarn.

In addition to the one method shewn of availing themselves of a regulating power, arising from a connection of the motion

of the yarn or cloth with a certain part of the machine, the patentees next proceed to explain two other methods of gaining the required motion.

Let *a*, fig. 12, represent a roller, deriving rotary motion from the warp or cloth; and *b*, another, having rotation imparted thereto from the crank-shaft, or other such part of the loom,—the two revolving at an uniform rate when the desired number of picks are going in. A band or chain *c*, passing over the rollers *a*, *b*, carries, at its lower end, a roller *d*, and, at its upper part, another *e*, which is weighted. It is evident that, as long as the speeds of *a*, and *b*, are uniform, no alteration will take place; but should the one revolve faster than the other, then the roller *d*, will be caused to rise or fall, and afford the desired medium for the regulating motion. At fig. 13, *a*, represents a shaft, deriving its motion from the warp or cloth; and *b*, another, connected to the crank-shaft, or other such part, as aforesaid. On the shaft *a*, a screw is formed, which works in a screw-socket of the shaft *b*. So long as their revolving rate is equal, no effect will take place; but, upon a variation of speed occurring, they will recede from or advance towards each other; and from this variation the required governing power may be taken.

The third part of this head of the invention is described, for the sake of convenience, as applied to the patentees' improved weft-detector, already shewn at figs. 8, and 9. To the shaft I, (answering to that marked with a similar letter in figs. 2, and 3,) is connected a click 31, which takes into the teeth of a segmental rack 32, formed upon the upper part of a lever 33, which lever is capable of turning upon a centre pin 34, attached to the framework, and passes through a guide-bracket 35. There is also a detaining click 36, applied to the teeth of the rack, for the purpose of preventing a retrograde motion when the click 31, is receding from its action. The operation is as follows:—Suppose the weft-thread to be broken, or otherwise absent, the rod I, will, by the means before described, or by the action of any ordinary similar apparatus, be caused to rock upon its centre, and thereby project forward the click 31, and, by advancing the toothed segment 32, turn the lever 33, upon its centre 34; and so on for each vibration of the shaft I, until the further end of the lever 33, is sufficiently raised to be within the operation of the wiper 36, which is mounted upon the tappet-shaft, or other moving part of the loom. This position of the parts is arranged to take place at the time that another advance of the click 31, will have brought a pin 37, which projects from the rack 32, into contact with

the ordinary spring-lever 38: the wiper 36, therefore supersedes that final motion of the click 31, and, by turning the lever 33, upon its centre 34, forces the pin 37, against the said spring-lever, and throws off the driving-strap in the usual manner. Connected to the spring-lever 38, is an inclined-plane piece 39, which, as the said lever moves in throwing off the driving-strap, passes under the clicks 31, and 36, and, by reason of its inclined shape, raises them from the teeth of the rack 32, so as to allow it to fall again into its starting position. By this arrangement, a stopping of the loom may be effected at any desired position of its parts, by bringing the lever 33, within range of the wiper 36, at any given period; or the loom may be allowed to continue for any number of revolutions after the weft-thread has been absent,—this being often desirable where weft is used which frequently breaks and catches hold again.

If desired, this last described improved apparatus may be connected to the ordinary knocking-off band; and, for this purpose, upon a centre-pin, attached to the framework, is mounted a tumbler 58, one end of which is connected to a rod or cord 59, which extends across the width of the loom: the other end of the said tumbler is bent so as to occupy a position behind the pin which projects from the segmental rack 32. By pulling the rod or cord 59, the tumbler will be caused to turn upon its centre and so project forward the rack 32, within range of the wiper 36; which motion will, as already explained, throw the spring-lever 38, out of its notch.

The fourth part of this head of the invention is shewn at fig. 14, and also at figs. 8, and 9; the former being a view of certain parts of a loom, shewing a mode of applying a stop-catch to the slay. A bar 59, is connected by a centre-pin 60, to any convenient stationary part of the machine, or to a spring attached thereto. This bar carries an arm 61, which is capable of turning upon a centre at 62, and is provided at its other end with a catch 63. Beneath the arm 61, is placed a bent lever 64, mounted on a centre-pin 65; and one part of this lever is acted upon by a wiper 66, affixed to the tappet or other convenient shaft, so as to cause it to vibrate upon its centre and thereby lift the catch 63, at each revolution of the shaft. One end of the bar 59, projects through a spring-rod 67, which is connected at bottom to any stationary part, and lies in the notch with the ordinary spring-lever. To the under side of the slay is affixed a projecting piece 69, above the bottom part of which the catch 63, is raised by the wiper 66; but, as in the ordinary working of the loom those parts are

not opposite to each other in the direction of the width of the machine, no effect will take place: if, however, the spring-lever 68, be removed from the notch by the weft-detector apparatus, in order to shift the driving-strap, then the rod 67, being forced out with it, will cause the bar 59, to turn upon its centre 60, so as to bring the catch 63, into coincidence with the projecting piece 69, when the wiper 66, at its next operation, will cause the former to arrest the motion of the slay. In case it should be desired to bring the spring-lever 68, into action, then the attendant must knock out the spring-lever 68, only; and the operation may be performed in the usual manner. In order to bring the spring-lever 67, again to its notch, when knocked out by the weft-detector, there is a pin 67*, affixed to the lever 68, which, by projecting behind the lever 67, causes the two to move back together.

Another arrangement for effecting this part of the invention is shewn at fig. 8, of the drawings. In this instance, there is a spring-lever 70, fixed at one end to the framework of the machine; its other end being bent inwards, so as to pass through the ordinary spring-lever 38. Upon the edge of the piece 70, there is a projecting part 71, which, when the spring-lever is moved to shift the driving-strap, arrives against the face of a spring 72, fixed to the back part of the slay, and thus assists in arresting the motion thereof.

The patentees claim, under the first head, with reference to those machines commonly known as billys, jacks, and mules, the application of a spring-catch, with a hooked-shaped recess formed therein, for the purpose of detaining the carriage when run out.

Under the second head they claim, Firstly,—the use of a wire or other instrument, which detects the undue absence of a weft-thread, by being brought into such a situation that the said thread shall loop upon it if in its proper position; but which, in conjunction with suitably-arranged apparatus, allows the loom to be stopped if the thread be absent. Secondly,—the use of a motion obtained by connecting the yarn or the cloth with any suitable working part of the loom, for the purpose of governing the giving off of the warp, or taking up of the cloth. Thirdly,—the use of an intermediate apparatus, connecting "stop-motions" of looms to those parts by which the stopping is immediately effected, for the purpose above set forth,—whether such stop-motions be applied to the weft or warp-threads, or consist simply of hand-gear. Fourthly,—the application of a catch, placed in connection with any suitable part of the apparatus used for stopping the loom, so

arranged as to hold the slay, or an attachment thereto, when desired, in order to arrest the motion thereof.—[*Inrolled November,* 1850.]

To PAUL D'ANGELY, *of Paris, in the Republic of France, Gent., for certain improvements in the construction of privies and urinals; and in apparatus and machinery for cleansing privies, cesspools, and other places; and in deodorizing the matter extracted therefrom, and rendering it available for agricultural purposes.*—[Sealed 4th June, 1850.]

THE principal end of this invention is to obtain the deodorization of every species of excretia, fecal matter, or urine, at the moment when it falls from the human body. This system is applicable only to privies and urinals as ordinarily constructed; and, therefore, it does not embrace water-closets, or other improved conveniences, within dwelling houses. To obtain the result proposed, with respect to privies, the patentee makes use of a box of wood or iron, or other receptacle, placed beneath the seat, in communication with a glazed earthenware basin, of a conical shape, as shewn in Plate VI., at fig. 1, wherein *a,* represents the basin, and *b,* the box or receptacle, which may be constructed to contain from twenty-five to fifty gallons of matter. This box is furnished with handles, to assist in its removal when full; and there is a lid *c,* of galvanized iron or zinc, provided for the purpose of closing, hermetically, the orifice of the point of junction between the basin and the box. Before the box *b,* is placed beneath the privy, it will contain deodorizing fluid, in the proportion of seven and a half per cent., according to the size of the box.

With respect to urinals, the patentee proposes to construct them in a concave form, as shewn at fig. 2,—the upper part *d,* being of brick or stone, and the lower part *e,* of glazed earthenware. Within this lower part a glazed earthenware basin *f,* covered externally with galvanized iron or zinc, is placed, and made to communicate by means of a tube *g,* with a cemented brick reservoir *h,* containing deodorizing fluid, as in the former instance. Attached to one side of the reservoir *h,* and in communication with it, is a glazed earthenware tube *i,* of a diameter of from two to three inches, and of a length proportionate to the urinal. This tube *i,* entering the reservoir, will serve to shew when it is full; in which case the matter may be emptied by means of a syphon. A lid of galvanized iron *k,* closes the

top of the tube *i*, and is locked, except when it is desirable to ascertain the contents of the reservoir. The lower part *e*, of the concavity of the urinal, is made of glazed earthenware, to prevent the accumulation of ammonia, which might be the case if stone or brick were used.

With respect to cesspools, the patentee forms them of brick or stone cemented, or of glazed earthenware, and introduces into them deodorizing fluid, in the same proportion as before mentioned; and, in removing the matter from the cesspools, he makes use of a wooden cask (fig. 3,), girt with iron, calculated to contain about five hundred and twenty-five gallons, and fills the same by means of an air-pump. At the top of the cask is an indicator, for shewing when the cask is full. To get the cask, when full, upon a waggon or other vehicle, and to facilitate the emptying of it when arrived at its destination, an inclined plane (fig. 4,) is employed. To allow of the cask being emptied, it is provided with a galvanized iron lid *a*, capable of fitting hermetically, and being easily opened to allow the matter to escape.

The deodorizing fluid is composed of fresh bark, rue or wild mint, sulphate of iron, and pyrolignite of iron, in the following proportions:—For every two hundred pounds of bark, the patentee takes forty pounds of green rue or wild mint, or, when dried, eighty pounds,—two hundred pounds of sulphate of iron, and one hundred and sixty pounds of pyrolignite of iron. In preparing the fluid he uses a pan, capable of containing about two hundred gallons; and in it he places one hundred and sixty-five gallons of pure soft water. The water is heated over a fire, and, whilst boiling, the bark is thrown in and allowed to remain until completely macerated. In another pan, of the capacity of about one hundred and ten gallons, about eighty-five gallons of pure soft water are boiled, and, while in a boiling state, the rue or wild mint is added, and left until macerated. The infusions of bark, and of rue or wild mint, are then cleared; the two liquids are mixed in a pan, large enough to contain three hundred gallons; the sulphate of iron and the pyrolignite of iron are added to this mixture; and the whole is heated sufficiently to produce complete solution. This done, sufficient pure water is added to make up the quantity lost by boiling, so as to have the amount of two hundred and fifty gallons. The specific gravity of the fluid, when made, ought to mark, according to Baumé's scale, not less than 15°(1·116), or more than 16°(1·125). The effect of the deodorizing fluid will be to prevent any unpleasant odour, by its power of concentrating the whole of the ammonia which

would otherwise be dissipated from the fecal matter and urine.

In order to convert the fecal matter into manure, it must be dried in a chamber, heated to from 70° to 90° Fahr. One half of the floor of this chamber should be composed of glazed earthenware tiles, of a prismatic form (see fig. 5,)—there being between the tiles spaces of about three quarters of an inch each. The fecal matter should be brought into the chamber and deposited upon the plain portion of the floor, until nearly dry, and then placed upon the tiles, which (each sloping) will allow the matter, as it becomes perfectly dry, to fall into the room beneath. The fecal matter, being reduced to powder, should then be mixed with dried or burnt peat, in powder, or with dried beasts' blood, also in powder, in the proportions of two-thirds of fecal matter to one-third of peat or blood. The manure will then be ready for use.—[*Inrolled December,* 1850.]

To HENRY COLUMBUS HURRY, *of Manchester, civil engineer, for certain improvements in the method of lubricating machinery.*—[Sealed 22nd May, 1850.]

THE first part of this invention applies to those working parts of machinery which are packed, for the purpose of preventing the passage of steam, water, or other vapour, or fluid, or for other like uses; and consists, firstly, in the application of a bush or hoop, placed within the packing, and so constructed as to form a reservoir for the oil or other lubricating material, and conduct the same to the circumference of the required parts; and, secondly, in providing a reservoir for the lubricating material within the piston of a steam-engine or other such moving part.

The second part of the invention relates to metallic packing, and consists in grooving or drilling the said packing, so that the lubricating material shall be distributed around its periphery.

The third part of the invention relates to an improved method of lubricating the axles of railway and other carriage-wheels, mill-shafts, or other such parts, and consists in forming a chamber within the revolving part, suitable for the reception of the lubricating material.

In Plate V., fig. 1, represents, in longitudinal section, a portion of a cylinder of a locomotive engine, shewing the application of the first part of the invention to the stuffing-

box and piston-rod (which example will also illustrate its adaptation to valve-rods, pump-rams, regulators, pipe expansion-joints, and all similar working parts); and fig. 2, is an edge view of the bush or hoop used for forming the reservoir, and conveying the oil, or other such material, to the required moving parts. The cylinder and cylinder cover are shewn at *a, a, a,* the gland at *b,* and the piston-rod at *c.* Within the stuffing-box is placed a bush or hoop *d,*—there being a thickness of packing on either side thereof. The bush consists of a cylindrical piece of metal, or other suitable material, the periphery of which is hollowed out towards its middle so as to form a channel around it;—this channel is provided with holes *e, e, e,* which communicate therefrom to the centre part *f,* of the said bush or hoop; and it is through this centre orifice that the moving part to be lubricated passes. Through the stuffing-box, and coincident with the situation of the bush or hoop *d,* an aperture *g,* is formed, which communicates with an oil-cup, of any ordinary construction, and provided, if desired, with a stop-cock, applied to the neck thereof, in order to admit the lubricating material at pleasure;—its lid closes with a light spring, as shewn in the drawing. The bush or hoop *d,* should be made to fit easily into the stuffing-box, so as to support itself without unduly pressing upon the working part, but sufficiently easy to communicate pressure, given by the gland, to the packing on the reverse side of the bush; and it should be bored or turned out to fit the working parts, so that the fibrous packing cannot be drawn between. The lubricating material passing from the grease-cup will flow into the channel formed by the hollowed part of the periphery of the bush or hoop; and from thence, passing through the apertures *e, e,* formed therein, will be distributed over the surface of the piston-rod.

Fig. 3, represents a portion of a stationary engine, partly in section, shewing the application of the bush or hoop to a hemp or other fibrously-packed piston. This figure also exhibits the bush or hoop applied to the piston-rod, precisely in the same manner as that described with reference to fig. 1. Fig. 4, represents a partial sectional plan or horizontal view of fig. 3;—the bush or hoop being shewn partly in section. The bush or hoop *d, d,* is placed within the fibrous packing of the piston, as described with reference to fig. 1, and may be supplied with oil, at intervals, by the introduction of any suitable apparatus through the cylinder-cover and piston.

The method by which this is effected constitutes another part of the invention, and is described as follows:—Within

the body of the piston *h, h, h,* is formed or attached a chamber or reservoir *i,* which, by means of pipes *j, j, j,* communicates with the bush or hoop *d, d, d,* (situated within the packing, as before described) at three points of its circumference: the chamber or reservoir *i, i,* may be supplied with oil, or other lubricating material, by various arrangements; but that shewn in the drawing is preferred. To the upper part of the chamber *i,* is adapted a stop-cock *k,* the interior of the plug of which is formed square, to receive the end of a tube *l,* which forms a channel for the passage downwards of the lubricating material from the grease-cup. This tube carries a valve at *m,* corresponding to a seat *n,* in the bottom of the grease-cup, and is connected, by means of a short rod, to a lever *o,* which is capable of turning upon a fixed centre *p.* Within the collar of the grease-cup, a spiral slot is formed, shewn by dots in the drawing at *q;* and within this slot is placed a pin, which projects from the outside of the tube *l;* so that, by turning the outward end of the lever *o,* downwards, the tube *l,* will be caused to rise, and, by means of the valve *m,* close the communication between the grease-cup and the interior of the engine cylinder; at the same time (through the intervention of the spiral slot) the tube *l,* will be caused to revolve, and communicate a like motion to the plug of the stop-cock *k;*—thereby shutting off the communication between the upper part of the cylinder and the chamber *i*: the descent of the tube, in like manner, opens the valve-seat *n,* and the communication between the grease-cup and the chamber *i.* When it is desired to afford a supply of lubricating material, the engine is turned until the piston is at the top of the stroke, and, being kept in that position, the tube *l,* is depressed, and the required supply effected as above described (which position of the parts corresponds to that shewn at fig. 3,); the tube is then caused to rise; and the engine may be put in motion. In order to provide for the escape of air from the chamber *i,* there is a second passage *r,* formed in the stop-cock; and this passage communicates with another *s,* which passes upward through the tube *l,* and is open at top to the external atmosphere. It will be observed, on inspecting the drawing, that that part of the tube which projects into the stop-cock is conically formed; the object of which is to ensure its entrance into the socket when moved downwards. The lubrication may also be effected by forming a communication from the chamber through a hole drilled lengthwise in the piston-rod, which, in this case, would be supplied with a grease-cup, similar to that described with reference to fig. 1,

and placed so near to the cross-head as to work clear of the stuffing-box. For the sake of illustration, the reservoir *i*, has been shewn in connection with that part of the improvements which relate to the bush or hoop; if desired, however, it may be used independently thereof; and the lubricating material may be conveyed to the required surfaces by means of any desired number of pipes, similar to those shewn at *j, j, j*, projecting, in such case, through the packing, when hemp or other fibrous material is used, or through the body and packing-ring of the piston, when metallic packing is employed. The reservoir *i*, may be a chamber, constructed in the casting of the piston; and the passages *j, j*, may, in like manner, be formed or drilled in the casting;—in all cases, however, where the stop-cock *k*, is used, it will be necessary that it be accurately ground to its seat, so as to be as nearly steam-tight as possible. If desired, the bush or hoop *d, d, d*, may be made in two or more segments; or of rolled metal, twisted to the form of a hoop, soldered or rivetted, and then properly turned and bored; and any practicable number of pipes *j, j, j*, may be employed for conveying the lubricating material thereto.

In adapting the improved bush to metallic packing, there should not be less than two rings or strata of packing on each side thereof, so that a lapping of the joints may be obtained, in order to prevent the steam, &c., from passing into the lubricating channel, and so to the other side of the piston. The method of supplying the lubricating material may, when the cylinder is vertical, be similar to that represented at fig. 3;—if horizontal, the piston may be provided with a plug stop-cock, of like construction to that shewn at *k*, fig. 3, through which the lubricating material may be supplied by means of a funnel, shewn at fig. 5. To the grease-cup or bowl is attached a tube *u*, which is surrounded by another tube *t*, capable of turning freely thereon; and in each of these tubes an aperture is formed, as at *v*, which, when brought into a coincident position, allow of the oil, or other such matter, flowing therefrom. The apparatus is to be introduced through the cylinder-cover, by means of a screwed plug-hole, and from thence made to project into the square socket of the plug of the stop-cock, in a similar manner to that described with reference to fig. 3,—the outside tube *t*, being properly shaped for the purpose. The holes *v*, being brought opposite to each other by turning the handle *w*, and the stop-cock being also thereby opened, the flow of the lubricating material from the grease-cup will be effected. Fig. 6, shews this apparatus adapted to be used for vertical cylinders in place of the fixed

apparatus described with reference to fig. 3. In the case of a horizontal cylinder, the reservoir, formed or placed in the piston, should be situate in the upper part thereof, so as to cause the oil, &c., to flow as high as possible: the bowl of the grease-funnel, when its tube is inserted through the cylinder end into the piston, should be high enough to cause the lubricating material therein to assume a level above the circumference of the cylinder.

The second part of the invention is shewn at fig. 1, which represents the metallic packed piston of a locomotive engine, constructed according to one plan of this portion of the invention. Upon the centre ring of the piston is formed a spiral groove, as at *x, x*; and leading from this groove are small channels, which communicate, by means of suitable pipes or passages, with a reservoir, similar to that shewn at *i, i*, fig. 3, and which may be supplied with lubricating material, as before mentioned. By disposing the groove in a spiral form, the lubricating material will, by the reciprocation of the piston, be projected upwards, and be thus assisted in distributing itself upon the peripheries to which it is intended to be applied: the said groove, however, may be formed parallel to the sides of the piston, or in any other line; or, in its place, a series of holes may be drilled, communicating, in like manner, with the reservoir.

The third part of the invention is shewn at figs. 7, 8, and 9, which represent, in two modifications, the improvement as applied to a railway carriage-wheel. Fig. 7, is a section of the wheel and its appurtenances, and fig. 8, a transverse view of the same, partly in section. The axle, upon which the carriage is suspended, is shewn at *a, a*, and is stationary, it being affixed to the plummer-blocks *b*. Upon this fixed axle are placed the brass or other metal bushes or steps *c*, upon which a hollow axle *d, d*, revolves,—the wheels *e, e*, being keyed or otherwise fastened thereon. The grease-box is shewn at *f*, in communication with the bottom of which there is a passage *g, g*, which is drilled lengthwise in the fixed axle *a*. Through this passage the oil or other lubricating material will therefore flow; and from thence it will pass through apertures *h, h*, formed in the steps or bushes, into the hollow revolving axle *d*, which thus becomes a reservoir. To prevent the oil, &c., from escaping at the outward end, there is a stuffing-box and gland applied, as at *i, i*.

In the modification shewn in section at fig. 9, the aperture, for the passage of the lubricating material from the grease-box, is at *k*; from thence it flows into a chamber, formed by

a ring of metal, or other suitable material *l*, which is placed in a groove, provided within the plummer-block, and pressed, by springs (one of which is shewn at *m*,) against the face of the boss of the wheel. This chamber may also be formed by lengthening the hollow axle *d*, until it is in close contact with the plummer-block *b*; and this contact may be preserved by means of a spring, attached to the end of the fixed axle *a*. The hollow running axle forms, as before, a reservoir for the lubricating material, which passes between it and the bushes or steps.

The patentee claims, Firstly,—the application of an apparatus, placed within the packing of moving parts of machines, suitably formed for acting as a reservoir, and for distributing lubricating materials. Secondly,—the application of a reservoir, for lubricating materials, placed or constructed within the pistons of steam-engines, or other such moving parts of machinery. Thirdly,—forming upon the peripheries of metallic pistons a groove or grooves, or holes, communicating with an internal reservoir, for the purpose above set forth. Fourthly,—the formation of a reservoir, for lubricating materials, within the revolving axle or shaft to which such substances are intended to be applied.—[*Inrolled November*, 1850.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for an invention of improvements in rotary engines,—being a communication.*—[Sealed 11th June, 1850.]

The object of this invention is to pack the junctions of the steam-wheel and heads of the steam-cylinder of rotary steam-engines in such way that the engineer shall be enabled to tighten or loosen the packing at his discretion, whether the engine be at rest or in action.

The invention consists in packing the ends of the steam-wheel and cylinder-heads of rotary steam-engines by means of metal rings, fitted one to each face of the steam-wheel, and adapted to slide in an annular groove in the cylinder-head or end of the casing which contains the steam-wheel; when the said packing-ring is combined with a series of segmental wedges, interposed between the said packing-ring and cylinder-head, and adapted to slide radially, and each coupled with a screw-shaft or spindle, which is free to slide endwise in a pinion; the series of pinions being so arranged as to be simultaneously turned in either direction by means of a cog-

wheel, on the main shaft of the engine, gearing into a worm on the shaft of a hand-wheel. By this arrangement, when the hand-wheel is turned, the series of segmental wedges will be simultaneously drawn in towards, or forced out from, the centre; and, by reason of their wedge form, will press the packing-ring towards the face of the steam-wheel, or release it from such pressure, and thus adapt the packing to the condition of the engine.

In Plate IV., fig. 1, is a vertical section, taken in a plane parallel with the shaft of the steam-wheel; and fig. 2, is another section, taken at right angles to fig. 1. *a*, represents one head of the cylinder *b*, within which is fitted the steam-wheel *c*, mounted on the main-shaft *d*, which passes through the centre of the head. Only a small portion of the cylinder and steam-wheel is shewn, as these form no part of the invention, and may be made on any plan. The inside of the head is formed with an annular groove *e*, to which a packing-ring *f*, is accurately fitted, to admit of its sliding in the groove. The outer periphery should be packed, as at *g*, in the usual manner of packing steam-joints, to prevent the passage of steam; and its inner face should be fitted by a ground joint to the face or end of the steam-wheel; so that when these two surfaces are in actual contact, they shall form a steam-tight joint. The other face of the packing-ring is in the form of the frustrum of a flat cone; and to this face are fitted a series of segmental wedges *h*, which slide radially between the conical face of the ring and the bottom of the groove *e*, and between guide-pieces *i*, *i*, that project from the bottom of the groove. To reduce the weight of the segmental wedges they are formed with open spaces in the body thereof. To each of the segmental wedges is coupled one end of a spindle *k*, which passes to the outside of the cylinder-head, and is adapted to turn and slide in a stuffing-box *l*; but this stuffing-box may be dispensed with. The inner end of the spindle *k*, turns and slides in suitable boxes, in two bracket-pieces *m*, *m*, on the cylinder-head, between which a bevil-pinion *n*, is mounted on the spindle;—the spindle being grooved at *o*, to receive a feather in the bore of the pinion, so that it may be free to slide in the pinion whilst it is turned by it. A screw-thread is formed upon the spindle at k^1, and passes through a nut *q*, attached to the cylinder-head; so that, when the pinion is turned to the right or to the left, the spindle will be caused to slide radially towards or from the centre of the main shaft, together with the segmental wedge, which is coupled to it. The segmental wedges are arranged at equal distances around the

circle; and each one is coupled to a screw-shaft or spindle, provided with a pinion, such as above described. The pinions *n*, all gear into the teeth of a bevil-wheel *r*, that turns between collars on the main shaft. The periphery of the said wheel is formed with teeth *s*, similar to those of an ordinary worm-wheel; which teeth work between the threads of a worm or screw *t*, on a shaft *u*, that has its bearings in bracket-pieces *v*, *v*; and the outer end of this shaft extends out beyond the periphery of the cylinder, and is there provided with a hand-wheel *w*, or with a winch.

From the above description it will be evident that, by turning the hand-wheel in one or the other direction, the series of segmental wedges will be moved in or out, and thus either free the packing-ring, or force it up against the face of the steam-wheel; and that, by reason of the multiplication of leverage, the engineer will be able to exert a very great force on the packing-ring, and be enabled at all times to adapt the packing to the condition of the engine, whether at rest or in motion.

The patentee claims the method, substantially as above described, of regulating the packing-ring, interposed between the steam-wheel and head of the cylinder or outer casing of rotary steam-engines, by combining with the said packing-ring a series of segmental wedges, operated simultaneously in manner substantially as described.—[*Inrolled December*, 1850.]

To Joseph Barrans, *of St. Paul's, Deptford, in the county of Kent, engineer, for improvements in axles and axle-boxes of locomotive engines and other railway carriages.*—[Sealed 24th November, 1849.]

This invention consists principally in employing adjustable wedges or filling-pieces to prevent the prejudicial endway motion of the axles in the axle-boxes of locomotive engines and railway carriages; and it also includes a mode of preventing grit getting into the axle-boxes; and certain means of saving or catching the grease used for lubricating the axles.

In Plate V., fig. 1, is an external view and fig. 2, a vertical section of an axle-box. *a*, is the journal of the axle, which is fitted with a bearing of the ordinary construction; and the end of the axle is faced with steel. *b*, is an end bearing-piece, which is made in the form of a wedge, and slides between two vertical guides; it is raised by turning the screw *c*, so as to adjust it to the proper distance from the end of

the axle, to allow of the latter revolving without friction, but, at the same time, to prevent any excess of endway motion; and the wedge is fixed, after being adjusted, by means of the set-screw *d*: the screw *c*, is also fixed by the nut *e*. As the bearing wears away, the end bearing-piece *b*, must be adjusted from time to time, so as to prevent the endway motion, which would otherwise take place.

Fig. 3, is an external view and fig. 4, a vertical section of another axle-box. *b*, is the end bearing-piece, fixed by an hexagonal boss in the socket *f*, which can be adjusted by means of the wedge *g*, so as to bring the end bearing-piece to the desired distance from the end of the axle. The wedge *g*, is provided with a screw stem g^1, to receive a nut *h*, by turning which the wedge is moved; and it is fixed, after the proper adjustment has been effected, by means of the nut *e*, and the set-screw *d*, fig. 3.

Fig. 5, is an external view and fig. 6, a vertical section of another axle-box. In this case the end collar of the axle is dispensed with. The end bearing-piece *b*, is fixed by an hexagonal boss in a screw-socket *i*; by turning which the piece *b*, is advanced to the end of the axle; and, after such adjustment, the socket *i*, is fixed by the nut *e*, and set-screw *d*, (fig. 5,) the point of which enters a groove cut in the thread of the screw on the exterior of the socket *i*. A hole or passage is formed through the centre of the socket *i*, for the introduction of a small rod or other suitable instrument to push out the piece *b*, when it is desired to remove it from the socket. In the ordinary grease receptacle *j*, of the axle-box, there is formed a small reservoir *k*, for oil, which is conducted therefrom, by a piece of cotton wick, into a small passage or opening above the end of the axle; and the oil is thus caused to drop between the end of the axle and the end bearing-piece *b*, and lubricate the same. This axle-box is also provided with parts *l*, *m*, for preventing the entrance of grit or dirt into it. *l*, is a flanged or dished ring, which is put upon the axle, and then the conical ring or shield *m*, is also placed on the axle and bolted to the back of the axle-box. It will be seen that the flanges of these rings interlock with each other, in such manner as to prevent the entrance of grit or dirt into the axle-box.

Fig. 7, exhibits a vertical section of another arrangement, in which the end bearing-piece *b*, is applied in the form of a hoop or ring upon the axle, at the back of the axle-box. It revolves with the axle, and is moved up to the axle-box, as the bearing wears away, by turning the nut *n*, which acts upon a

screwed portion of the hoop or ring *b*,—the hind end of the nut abutting against the boss *o*, of the wheel. The nut *n*, is prevented from turning, after the hoop or ring *b*, has been adjusted, by means of a guard *p*, which bears against one of the flat sides of the nut, and is fixed to the boss of the wheel by a screw or pin *q*.

Each of the axle-boxes, above described, is provided with a means for collecting or catching the grease that has passed over the bearing of the axle. In each figure *r*, is a grease-box or drawer, which slides or fits in the lower part of the axle-box, and is retained therein by a spring-catch *s*. The grease, after having passed over the bearing of the axle, falls into the box, from which it is removed from time to time and used over again, until it has been deprived of its lubricating quality.

The patentee claims, First,—the arranging axletrees and axletree-boxes, as described, with adjustable apparatus for making up for wear, in order to prevent prejudicial endway motion; and also the means of preventing grit from getting into axletree-boxes. Secondly,—the arranging axletree-boxes with a drawer or receptacle for catching the grease, as explained.—[*Inrolled May*, 1850.]

To John Hickman, *of Walsall, in the county of Stafford, clerk, for improvements in the manufacture of cylindrical and other tubes.*—[Sealed 25th May, 1850.]

The first part of this invention relates to the operation of drawing cylindrical or tapering tubes of metal; and consists in reducing such tubes to the desired size, by coiling wire around the front end of the tube, and then drawing such tube through the coil of wire, which is kept in a suitable state of tension, so as to act upon the tube in a similar manner to the dies of an ordinary draw-bench.

In Plate V., fig. 1, is an elevation and fig. 2, is a horizontal section of the apparatus used for carrying out this part of the invention: it is described by the patentee as applied to the manufacture of tapering tubes; but it is equally applicable to the manufacture of tubes having the same diameter throughout their whole length. *a*, is the framing of the apparatus. *b*, *b*, are two bars, the ends of which enter and slide in two grooves or recesses, formed in the upright standards of the framing *a*; and the bars are connected together by two cords *c*, *c*, which are secured, at one end, to the lower bar, and

after being passed over a pulley in the upper bar, a weight *d*, is attached to the lower end of each cord; so that the bars will thus have at all times a tendency to approach each other. *e*, *e*, are two upright bars, each connected to and supported by two parallel levers *f*, *f*; which levers turn on pins or axes, affixed to the upright standards of the frame *a*; and the outer ends of the levers work between guides *g*, *g*, and the sides of the standards. A weight *h*, is suspended from the lower end of the bars *e*, for the purpose of giving such bars a tendency to approach each other. *i*, is a tapering mandril, on which is placed the tube *j*, required to be drawn; around the tube a piece of wire *k*, is once passed; and the ends thereof being conducted over pulleys *l*, *l*, it is held in a suitable state of tension, either by means of springs, in the manner represented at *m*, or by the application of weights, as shewn at *n*.

By the above arrangement the wire will be caused to exert the degree of pressure requisite to effect the reduction of the tube which is being drawn through the coiled portion thereof; but, at the same time, the coil will gradually enlarge to suit the increasing diameter of the mandril. The coil of wire abuts against the projecting parts of the bars *b*, *b*, and against the sides of the bars *e*, *e*; and such bars may have suitable recesses formed in them for the reception of the coil of wire. These bars also serve as guides to keep the mandril and tube in a central position. Although the apparatus is represented as being applied to the manufacture of tubes which are of a circular form in the transverse section, yet tubes of any other desired section may be drawn in this apparatus, by substituting a mandril of a suitable form for the mandril shewn.

The second part of this invention consists in a method of manufacturing fluted or corrugated tubes, either of a tapering form or of the same diameter throughout. Fig. 3, is a horizontal section and fig. 4, a front view of the apparatus used for effecting this object. *a*, is a fluted mandril, which is represented of a tapering form; but when the tube is to be of the same diameter throughout, then the mandril must, likewise, be of the same diameter throughout. *b*, is the tube to be fluted or corrugated, which is placed upon the mandril. Upon the outer surface of the tube several rods or strips of metal *c*, *c*, are laid in such manner that each rod or strip will be over one of the longitudinal grooves of the mandril; and, consequently, each rod, if subjected to sufficient pressure, will press the intervening portion of tube into the corresponding groove of the mandril. The requisite pressure is applied by drawing the mandril, tube, and rods through a soft metal

die *d*; and, by this means, the tube is fluted or corrugated in the manner represented by the transverse section, fig. 5. In place of using a soft metal die, pressure may be applied to the rods by means of a coil of wire, as described in the first part of the invention, and as indicated by the dotted lines in fig. 3. The patentee states that he does not claim the use of a soft metal die, excepting when it is employed for the purposes of his invention.—[*Inrolled November*, 1850.]

To William Watson, *the younger, of Chapel Allerton, in the parish of Leeds, in the county of York, manufacturing chemist, for improvements in the preparation and manufacture of various materials to be used in the processes of dyeing, printing, and coloring.*—[Sealed 4th June, 1850.]

This invention consists in the preparation and manufacture of various solid compounds of indigo, or of preparations of indigo, with various alkalies or alkaline earths (viz., potash, soda, ammonia, barytes, strontia, lime, and magnesia), or with various salts of such alkalies or alkaline earths; so that such products may be economically produced in a dry state, and rendered more conveniently applicable for the dyeing, printing, and coloring of various matters or fabrics. This is effected by adding to, or mixing with, a solution or preparation of indigo in concentrated sulphuric acid, one or more of the above-mentioned alkalies or alkaline earths, or salts, so that the compound resulting from such mixture may be a solid product. On the score of economy, the patentee prefers to use the chloride of sodium or common salt, the carbonates or sub-carbonates of soda, of potash, or of magnesia, or the sulphate of potash.

In the preparation of such mixtures and compounds of indigo and salts as are herein mentioned, the patentee employs an apparatus similar to that shewn in vertical section in Plate V. *a, a,* is a cylinder of cast-iron, of the diameter of three feet, or thereabouts; within which is fitted, in any convenient and suitable manner, a cylinder of copper *b, b,* so that the space between the cylinders *a, a,* and *b, b,* shall be steam-tight. This space is connected by means of the pipe *c*, with a boiler, supplying steam at the pressure of about 20 lbs. per square inch. *c**, is a smaller pipe, for carrying away any condensed water. Within the internal cylinder or vessel is placed an agitator *d, d,* (having two or any convenient number of arms or blades) the shaft of which works air-tight through

a stuffing-box *e,* and, passing through the top or cover of the cylinder, is, by suitable gearing, made to revolve at the rate of about eighty revolutions per minute. *f,* is a small door, covering a corresponding aperture in the cylinder-cover, made readily removable, for the purpose of introducing solid matters therein, and capable of being made air-tight by suitable luting. *g,* is another door at the bottom of the cylinder, for the purpose of emptying the contents of the inner cylinder or vessel. *h,* is a pipe for carrying away any gas or vapor which may arise during the process; and it may, if required, be connected with any suitable apparatus for condensing such gas or vapor, and applying it to any useful purpose. *i,* is a bent tube, for the purpose of introducing the solution of indigo.

The patentee makes a solution of indigo in sulphuric acid, by adding about six parts, by weight, of concentrated sulphuric acid (the strongest being the best) to one part of the indigo of commerce: this solution, which is commonly called chymic, will be referred to as solution No. 1. But when a compound of superior quality for dyeing the best and brightest colors is required, then in lieu of using the indigo of commerce, refined or purified indigo is employed, and, by preference, that which has been refined or purified, by solution, with proto-sulphate of iron and lime, and afterwards precipitated and dried in the manner now well known and understood; and to every part of such refined indigo about ten parts, by weight, of concentrated sulphuric acid are added. In the following description the solution of refined indigo will be referred to as solution No. 2.

The way in which the solutions of indigo are mixed with the alkalies or salts is very similar with all the compounds; a description, therefore, of the process of mixing the solution of indigo with common salt will suffice to explain this part of the invention. The salt, having been carefully pulverized, is introduced by the door into the mixing apparatus hereinbefore described, which is kept heated by the admission of steam between the inner and outer cylinder;—the door is luted, so as to be air-tight; the agitator is then put into motion; and one of the solutions of indigo is poured slowly through the tube *i.* Hydrochloric acid gas is evolved by the action of the sulphuric acid on the salt, and is conveyed away by the pipe *h,* while the operation is continued, until the intended quantity of solution of indigo has been added, and the evolution of gas has nearly ceased: the compound will then be found to be dry, and may be allowed to fall through the door *g,* into any receptacle placed below. The patentee remarks, that he

prefers to make the other mixtures or compounds, herein described, in a similar manner, but that he does not find the application of heat, or of any special apparatus, so essential, with regard to other salts, as when chlorides are used. It is not essential to use any precise proportions of the solutions of indigo and the respective salts; but a sufficient quantity of the salt must be used to produce a compound which is sensibly or apparently dry, and in which the acid may be neutralized, if the compound be required to be neutral, or so that merely such a quantity of sulphuric acid may remain in the compound in excess as may be found advisable, when an acid compound is required. As the salts contained in some of the compounds, resulting from the processes herein described, combine with water, as water of crystallization, it will be found advisable, in some cases, to add to the compound so much water that the resulting compound may contain a due equivalent of water of crystallization. For instance,—when soda or magnesia, or the carbonates of soda or magnesia, are employed for making such compounds as herein mentioned, the ingredients are more readily combined, and a compound, less liable to change by exposure to the air, is formed, if, for every ten parts, by weight, of solution of indigo, about six parts of water are added;—the water being added towards the completion of the process of mixing. As some of the salts, which are formed by the combination of the alkalies or alkaline earths, herein named, with sulphuric acid, do not readily absorb water, as water of crystallization, it is advisable to add a proportion of such a salt, in an anhydrous condition, as will absorb any uncombined water which may exist in the compound. For instance,—when ammonia, barytes, or strontia are used for making these compounds, a suitable quantity of the dry sulphate of soda is added,—this salt being the best and cheapest for this purpose: other salts, however, in an anhydrous state, such as dry sulphate of magnesia, or the calcined sulphate of alumina and potash, will answer the same purpose, and therefore may, under some circumstances, be advantageously employed. The patentee remarks, that in various applications of the compounds produced for the purposes of dyeing, printing, and coloring, such compounds may be required to be acid, alkaline, or neutral; and, in like manner, the preparations made with the solution No. 1, are sufficient for many purposes, and are cheaper than those made with the solution No. 2; whilst, for the production of bright colors, a preparation is made with the solution No. 2, which is superior to that made with the solution No. 1; and,

in like manner, various alkalies or alkaline earths, or salts of these, may be found requisite or preferable. He does not, therefore, confine himself to the use of any one salt or pure salt, in making such compounds; for it may be found desirable to add to some of the before-mentioned compounds another salt or alkali, for the purpose of more readily neutralizing any excess of acid; for instance:—It will be advantageous, after making the hereinbefore-described compounds of either of the solutions of indigo and common salt, to add such a quantity of carbonate of soda, of carbonate of potash, or of carbonate of magnesia, that the compound shall, on trial, be found neutral. Although it is not considered essential to use any precise proportions of ingredients, yet, as a general guide, the following formulæ (the parts being estimated by weight) are given,—the carbonate of potash of commerce being estimated to contain fifty per cent. of real potash, the carbonate of soda of commerce to contain fifty per cent. of real soda, and the carbonate of magnesia of commerce to contain forty per cent. of real magnesia:—

No. 1.—100 parts of either of the hereinbefore-mentioned solutions of indigo, and 200 parts of common salt or chloride of sodium.

No. 2.—100 parts of either of the solutions of indigo, 200 parts of common salt, and 20 parts of carbonate of magnesia.

[The carbonate of magnesia is to be added after the solution and common salt have been well mixed, and is for the purpose of neutralizing any free acid.]

No. 3.—100 parts of either of the solutions of indigo, and 230 parts of sulphate of potash.

No. 4.—100 parts of either of the solutions of indigo, and 90 parts of caustic potash, for a neutral compound.

No. 5.—100 parts of either of the solutions of indigo, and 45 parts of caustic potash, for an acid compound.

No. 6.—100 parts of either of the solutions of indigo, 60 parts of caustic soda, and 60 parts of water.

No. 7.—100 parts of either of the solutions of indigo, and 36 parts of caustic magnesia.

No. 8.—100 parts of either of the solutions of indigo, and 86 parts of the carbonate of potash of commerce, for an acid compound.

No. 9.—100 parts of either of the solutions of indigo, and 175 parts of the carbonate of potash of commerce, for a neutral compound.

No. 10.—100 parts of either of the solutions of indigo, 115 parts of carbonate of soda of commerce, and 60 parts of water.

No. 11.—100 parts of either of the solutions of indigo, 82 parts of carbonate of magnesia of commerce, and 60 parts of water.

No. 12.—100 parts of either of the solutions of indigo, 200 parts of carbonate of baryta, or 150 parts of carbonate of strontia, or 90 parts of carbonate of ammonia; and, after the solutions of indigo have been mixed with such salts respectively, 50 parts of dry sulphate of soda,—this latter substance being added for the purpose of absorbing any uncombined water.

In conclusion, the patentee states, that he is aware that manufacturers of preparations of indigo have been accustomed to precipitate indigo from a sulphuric acid solution, by the addition of common salt, or other salts; such solution of indigo in sulphuric acid having been considerably diluted with water,—that is to say, diluted with more than five times the weight of the sulphuric acid,—the resulting compounds of such a process being in a state of paste. He therefore wishes it to be understood, that he does not claim to manufacture any compound of indigo with the salts or substances herein mentioned, by precipitating indigo from a diluted solution in sulphuric acid; but he claims, Firstly,—the adding or mixing a solution of indigo in sulphuric acid to or with common salt, in manner hereinbefore described. Secondly,—the adding or mixing a solution of indigo in sulphuric acid to or with sulphate of potash. Thirdly,—the adding or mixing a solution of indigo in sulphuric acid to or with caustic potash, caustic soda, or caustic magnesia. Fourthly,—the adding or mixing a solution of indigo in sulphuric acid to or with the carbonate of potash, carbonate of soda, or carbonate of magnesia. And, Lastly,—the manufacture of solid compounds or preparations of indigo, by the admixture of any suitable alkali or alkaline earth, or the salt of any alkali or alkaline earth, with a solution of indigo in sulphuric acid, so as to form dry or solid compounds, of the nature hereinbefore set forth.—[*Inrolled December,* 1850.]

To Henrietta Brown, *of Long-lane, Bermondsey, widow and executrix of the late Samuel Brown, for improvements in the manufacture of metallic casks and vessels,—being a communication.*—[Sealed 17th July, 1850.]

This invention consists in fixing the heads of metallic casks and the bottoms of metallic vessels, and joining other parts of metallic vessels, by corrugating the two thicknesses of metal which are to be connected together.

In Plate VI., fig. 1, is a vertical section of a can or metal vessel, the bottom and neck of which are connected to the body according to this invention; and fig 2, is a section of a pair of rollers by which the corrugation is effected. These are the only drawings that accompany the specification; as the patentee has not thought it necessary to give a representation of a metallic cask; because the heads or ends of casks are to be fixed in precisely the same manner as the bottom of the vessel shewn at fig. 1. In order to fix the bottom of the can or vessel, it is placed in its proper position, with its flange or rim in contact with the inner side of the metal body; then the two thicknesses of metal are passed between a pair of rollers, one of which has a projecting bead around it, and the other a corresponding groove, as exhibited at fig. 2; and these rollers are caused to exert a sufficient pressure upon the metal to produce the corrugation shewn at *a*, fig. 1. On examining the drawing it will be seen that the convex side of the corrugation in the flange of the bottom fits closely into the concavity of the corrugation around the lower part of the body; and thus the bottom is securely attached to the body without the aid of rivets: the corrugation of the metal likewise imparts additional strength to the parts. The neck of the can or vessel is fixed to the body in like manner, by inserting the lower part of the neck in the upper part of the body, and then subjecting the two thicknesses of metal to the action of a suitable pair of rollers (one of which is placed inside the neck), whereby a corrugation is produced, as represented at *b*, which unites the two parts securely together. In place of the two thicknesses of metal being corrugated together, they may be corrugated separately, and afterwards brought together in such manner that the convex side of one corrugation will fit into the concave side of the other corrugation. The joints may be made fluid-tight by the application of melted tin or solder.

In conclusion, the patentee says, "I would have it understood, that although I have only shewn a single corrugation, I do not confine myself thereto, as more may be employed; but what I claim is the causing heads of casks and bottoms of vessels to be fixed, and other parts of iron vessels to be joined, by corrugating the two thicknesses of metal."—[*Inrolled January,* 1851.]

To George Allen Everitt, *of the firm of Allen Everitt and Son, of the Kingston Metal Works, in the borough of Birmingham, metal tube manufacturers, and* George Glydon, *of Birmingham, aforesaid, engineer and foreman to the said Allen Everitt and Son, for certain improvements in the manufacture of metal tubes for locomotive, marine, and other boilers.* [Sealed 12th June, 1850.]

It is well known that the tubes of locomotive and other boilers are commonly worn out or destroyed at one end by the intense heat to which such end is subjected, whilst the other portions are comparatively uninjured, or but slightly worn; and there are many practical difficulties in the manufacture of such tubes with an increased substance of metal at one end, for the purpose of equalizing the wear. Now this invention consists in the application of a shield or short tube to one end of such tubes, so as to protect the same from the intense action of the heat, and render the wear of the tubes more uniform.

In Plate VI., fig. 1, is a longitudinal section of a tube with one of the shields or short tubes applied thereto; figs. 2, and 3, are end views of the tube; and fig. 4, exhibits the mandril used when fixing the shield or short tube in its place. The mandril is reduced in diameter at one end for a distance somewhat exceeding the length of the shield or short tube; on this reduced part the short tube *a,* is placed; then the mandril, with the short tube upon it, is introduced into the long tube *b*; and the whole is subjected to the action of the apparatus commonly used for drawing tubes. By this means the short tube *a,* is firmly fixed in the tube *b*; and the mandril is then withdrawn. To facilitate the withdrawal of the mandril, both parts thereof (*i. e.* the reduced portion and the part which comes in contact with the interior of the tube *b,*) are made slightly tapering. The tubes *a,* and *b,* are, in the act of drawing, gradually reduced in thickness, to a slight extent, from one end to the other, as shewn in figs. 1, 2, and 3. Instead of fixing the short tube in the end of the longer one by drawing upon a mandril, the short tube may be forced by pressure into its place. These short tubes may be made to serve as substitutes for the ferrules used in fixing the tubes in the boilers; or the ferrules may be employed therewith in the ordinary way.

The patentees state that they do not claim the introduction of a short tube into the ends of the metal tubes of boilers, when the length of such short tube is less than twice its

diameter; nor do they claim the lining the whole length of a tube with another tube; but what they claim, as their improvements in the manufacture of metal tubes for locomotive, marine, and other boilers, is the application to one end of such tubes of a shield or short tube, whose length exceeds twice its diameter, but is less than half the length of the tube into which it is introduced, as above described.—[*Inrolled December,* 1850.]

To John Silvester, *of West Bromwich, in the county of Stafford, whitesmith, for improvements in straightening, flattening, setting, and shaping hardened steel.*—[Sealed 17th July, 1850.]

The patentee remarks, at the commencement of his specification, that many articles composed of steel, such as saw-blades, are spoiled by becoming warped in the process of hardening, which renders it necessary for them either to be hammered into form, or softened and re-hardened; and in some cases they are so damaged that they have to be altogether thrown aside. This invention consists in straightening, flattening, setting, and shaping such plates and other articles as may be warped in the process of hardening, by pressing them between dies, previous to or while they are in the course of being tempered.

In Plate VI., fig. 1, is an end elevation, fig. 2, a vertical section, and fig. 3, a plan view of a machine used in carrying out this invention. A, is a metal frame, fixed upon a basement-plate B, which also supports two rails C, C, whereon the wheels D, D, of the carriage E, travel. This carriage carries two dies F, F, between which the steel plates to be straightened, flattened, or set, are placed, and the carriage is then run in beneath the screw G, which works in a female screw, formed in the upper part of the frame A; or the steel plates may be put between the dies after the carriage has been brought beneath the screw G. A bar or beam H, is placed beneath the lower die, for the purpose of relieving the axles of the carriage E, from the pressure to which the dies are to be subjected; and then, by means of the hand-wheel I, the screw G, is turned, until the upper die presses uniformly upon the plate or other article between it and the lower die. The dies are now bound firmly together by means of clamps, the pressure of the screw G, is removed, and the bar or beam H, is withdrawn; and then the carriage E, is pushed along the rails C, C, into the furnace, in order that the plate may be

heated to the temperature necessary to bring back the article to the proper temper. The patentee states that "the upper die can be raised by means of the screw, and the introduction of the sliding-frame H^2, to such an extent as to admit of the plates being either removed or introduced at pleasure;" but he does not give any further explanation of the mode of doing this: it may, therefore, be well to remark, that the frame H^2, consists of a collar, which rests upon a shoulder at the top of the screw G, and of two legs, which can be connected, at their lower ends, by means of screw-bolts, with two lugs or projections on the top die; and hence, when the screw G, is raised, by reversing the motion of the hand-wheel I, it will lift the frame H^2, and with it the top die. In place of running the carriage, with the articles to be tempered, into the furnace, the dies may be previously heated to such a degree as to bring back the steel to the desired temper; and, in this case, the upper die is raised by means of the frame H^2, and the article introduced; and then the requisite pressure is produced by means of the screw G, and hand-wheel I, as before described.

Fig. 4, exhibits a pair of dies, suitable for straightening, flattening, setting, shaping, and tempering thin steel plates, on which the weight of the upper die may be sufficient for producing the necessary pressure without the use of a screw or other press. The upper die *a*, is jointed to one end of a lever *b*, the other end of which works on a fixed point *c*. These dies may be heated previous to the steel plate or other article being placed between them; or the whole may be heated together in a furnace.

Instead of employing the heat of a furnace to bring back plates and other articles of hardened steel to the requisite temper, the patentee sometimes uses perforated dies, into the hollows or cavities of which molten lead or other metal is poured, so as to raise the temperature of the dies to the proper degree for tempering the articles. He also tempers blades, plates, and other articles of hardened steel, by immersing them in a bath of molten lead or other metal, and at the same time straightens, flattens, and sets such articles, by placing the same between dies which are perforated all over, so as to permit the molten metal to speedily communicate the requisite temperature to the articles.

The patentee claims the straightening, flattening, setting, and shaping of plates and other articles of hardened steel by mechanical pressure, previous to or while they are in the

course of being tempered (the pressure being continued during the process of tempering), as before described.—[*Inrolled January*, 1851.]

To JOHN MILWAIN, *of Manchester, in the county of Lancaster, joiner, for certain improvements applicable to the closing of doors, windows, and shutters.*—[Sealed 12th January, 1850.]

THIS invention consists in certain arrangements of apparatus for more effectually preventing the passage of sound and air, and of dust or other impurities, into rooms, closets, cabinets, bookcases, or other receptacles, which are furnished with doors, windows, or shutters. The peculiar feature of the first part of the invention consists in the employment of a moveable strip of India-rubber or gutta-percha, so applied to one part of the joint intended to be secured, as to press firmly upon the other part of the said joint, when the door, window, or shutter, is closed; but capable of receding therefrom when it shall be desired to open the door, window, or shutter.

The second part of the invention consists in a peculiar mode of applying India-rubber or gutta-percha for the purpose of closing, as aforesaid, what are commonly called French windows, and other apparatus, which open and close after the manner of folding doors.

At fig. 1, Plate VI., one arrangement for carrying out the first part of this invention is shewn, as applied to an ordinary room door,—the figure being a front elevation in section, and shewing the door partly open, and the moveable strip raised from the floor. To the inside of the door A, a brass or other plate *a, a,* is attached by screws; and to this plate are fastened, by rivets or otherwise, the upper ends of two pieces of vulcanized India-rubber *b, b*; the lower ends thereof being affixed to a metal casing *c, c, c,* within which is also confined, by means of rivets, another strip of vulcanized India-rubber or gutta-percha *c*, c*, c**, extending throughout the width of the door. Upon the plate *a, a,* are affixed centre pins, upon which cams *d, d,* are mounted, so as to turn freely thereon: the lower ends of these cams are in contact with the top of the metal casing *c, c,* and their upper ends are connected, by means of joints, to a longitudinal rod *f, f.* Within the door-jamb is placed a screw-stud *g,* capable of adjustment in the screw-box *h, h*: by this arrangement it will be perceived that, on closing the door, the end of the rod *f, f,* will arrive in contact with the stud *g,* and thereby be forced inwards; by

which action the cams *d, d,* will be turned upon their centre-pins, and force down the metal casing *c, c,* which, carrying with it the strip of India-rubber or gutta-percha *c*, c*, c*,* will effectually close the bottom of the door. By turning the screw-stud *g,* in its screw-box, and thereby carrying it nearer to, or further from, the rod *f, f,* more or less action will be given to the cams *d, d,* and, consequently, a like variable motion to the strip *c*, c*, c*.* When it is necessary to open the door, the pieces of vulcanized India-rubber *b, b,* which, by the descent of the strip *c*, c*,* have become distended, will, by their contraction, turn the cams *d, d,* back again upon their centres, raise the strip *c*, c*, c*,* from the floor, and allow the door to open freely.

Fig. 2, shews another arrangement of the invention applied to a door. In this instance, in place of the cams *d, d,* two sets of toggle-jointed levers are employed; the upper ends *i, i,* turning upon pins attached to the plate *a, a*; and the lower ends *i*, i*,* being connected to centre-pins, affixed to the metal casing *c, c.* The centre-pins of the toggle-jointed levers work in slots, formed in the rod *f, f,* as shewn in the drawing; which rod *f, f,* in this instance, moves in guides *j, j.* To the casing *c, c,* are affixed studs *a*, a*,* which project into grooves formed in the plate *a,* in order to cause the strip *c*, c*, c*,* to descend with a parallel motion. In the figure the door is supposed to be closed; the rod *f, f,* having been brought into contact with the screw-stud *g,* and thereby made to act on the toggle-jointed levers, so as to effect the descent of the strip *c*, c*, c*.* On the door being opened, the pieces *b, b,* will contract, and raise the casing *c, c.*

Figs. 3, and 4, shew the invention as applied to the closing of sash-windows; fig. 3, being a partial sectional elevation of a window, and fig. 4, a sectional plan of the same,—the top plate *a, a,* which carries the apparatus, being removed, in order more clearly to shew the various parts. The metal casing *c, c, c,* and strip of India-rubber or gutta-percha *c*, c*, c*,* are shewn as abutting against the upper window A, A, in which direction they are constantly forced by means of two springs *k, k*; one end of each of which is affixed to the sash of the window,—the other ends acting against pieces affixed to the under side of the casing *c, c, c.* The casing *c, c,* is provided with pins *l, l,* which project into grooves made in the plate *a, a,* so as to form parallel guides; and to it are attached inclined planes *m, m,* against which pins *n, n,* affixed to the rod *f, f,* are caused to work. Upon raising the lower window B, the rod *f, f,* will

be forced up the inclined plane *o*, (placed in a recess formed in the frame of the window,) and, by this means, be caused to move inwards in its parallel guides *j, j*,—thus carrying the pins *n, n*, along the inclined planes *m, m*, and drawing the strip *c**, *c**, *c**, away from the upper window A. Upon again closing the window, the springs *k, k*, will force forward the strip *c**, *c**, *c**, into its former position, and the rod *f, f*, will again recede along the inclined plane *o*.

Figs. 5, and 6, shew the improvement as applied to a window which opens at top and bottom; fig 5, being a partial front view of the two windows, and fig. 6, a representation of the inside of the window-frame.

The inclined plane *o*, (referred to in the last-described figures) is mounted upon a short axis *q*, extending across in the direction of the width of the two windows, and carries, at the opposite end to that upon which the inclined plane *o*, is mounted, a projecting arm *r*; and to the upper window A, an inclined plane *s*, is attached, which moves in a groove *s**, formed in the window-frame. Upon commencing to lower the upper window, the arm *r*, is forced inwards by the inclined plane *s*, moving against the projecting part *r**: the axis *q*, is thereby turned upon its centre, and the rod *f*, is driven inwards; which movement, through the means described in reference to figs. 3, and 4, liberates the window from the strip *c**, *c**.

Fig. 7, shews, in sectional plan view, a method of applying the improvements to the tight closing of windows, when the closing is effected by the hand. The metal casing *c, c, c*, is provided, as before, with pins *l, l*, moving in parallel guides, formed in the plate *a*, which is removed in order to expose the parts. To the casing *c, c, c*, a screw-pin D, is connected by means of a socket-joint; and, by turning this pin, which works in a screw-box fixed in the sash of the window, the strip *c**, *c**, *c**, will be tightened upon or loosened from the upper window A.

Fig. 8, represents a modification of the invention, adapted for closing doors, windows, or shutters, by hand: that is to say, by means independent of the opening and shutting of the said door, window, or shutter. A, and B, represent portions of the meeting stiles of the glass-doors of a book-case or cabinet,—the front plate *a*, of the preceding figures being removed, in order to expose the parts. To the under side of the metal casing *c*, of the strip of India-rubber or gutta-percha *c**, *c**, there is attached, by means of a bracket, a pin

t, which projects into an excentric groove *u*, formed within a tumbler that turns upon a centre-pin *v*,—the said tumbler-pin being affixed to a knob on the outside of the door. By turning this knob, the pin *t*, and, consequently, the strip *c**, *c**, will be drawn from contact with the other door, which will then be at liberty to be opened; and, on being again closed, a reversed motion of the knob will cause the strip *c**, to assume its former position.

The patentee remarks that, if desired, the plate *a*, *a*, may be placed on the outside of the door, and that a similar apparatus may be adapted to the top; also that springs, of any suitable shape or material, may be employed instead of those formed by the pieces of India-rubber *b*; and that the strip may be withdrawn by the action of the door, and forced forward, by means of springs, in a similar manner to that described with reference to figs. 3, and 4.

The second part of the invention is shewn in partial sectional plan view at fig. 9, which represents the improvements applied to a French window. Throughout the length of the side-framing a groove is formed, within which a strip of India-rubber or gutta-percha *c**, confined by rivets or otherwise within a metal casing, is placed; there is also a groove *w*, formed in the window-jamb, into which the strip of India-rubber or gutta-percha passes when the window is closed, abutting against the edge of the said groove, and thereby closing the joint, as shewn in the drawing. The method of closing the meet of the windows is as follows:—The meeting-stile of each window does not close, as in the ordinary construction, but there is a hollow passage left, as shewn at *x*. To each meeting-stile is attached a strip of India-rubber or gutta-percha *y*, *y**, firmly enclosed within a metallic case, and extending throughout the length of its respective window: the outward edge of one of the strips *y*, presses (when the windows are closed) against the part *z*, of the window C; the other strip *y**, being in contact, in like manner, with the part *z**, of the window D. If desired, the method described, under the first head of the invention, may also be applied for the purpose of closing the tops and bottoms of the windows. This part of the invention is also proposed to be applied to shutters which open in a similar manner to French windows, to the glass or other doors of book-cases and cabinets, &c.

The patentee claims, Firstly—the use of a moveable strip of India-rubber or gutta-percha applied to the joints of doors, windows, and shutters, for the purposes above set forth, whether such strip be brought into action by the motion of the

said doors, windows, or shutters, or by a subsequent operation of the hand. And, Secondly,—the mode of applying India-rubber or gutta-percha to French windows, and other such contrivances, which open after the manner of what are commonly called folding doors.—[*Inrolled July,* 1850.]

To JAMES PALMER BUDD, *of the Ystalyfera Iron Works, Swansea, merchant, for improvements in the manufacture of coke.*—[Sealed 11th June, 1850.]

THE patentee commences his specification by stating that the coals of this country may be divided into two classes, viz., caking and non-caking coals,—the former, on the application of heat, running together into a mass, and the latter, on heat being applied thereto, separating into small pieces. Coke has heretofore been made from the caking coals alone; and the non-caking coals, when below a certain size, have been considered almost worthless; as they cannot be consumed with advantage; and their want of coherence renders them unfit for making coke. Now, this invention consists in employing small non-caking coals in the manufacture of coke, by mixing the same with a suitable quantity of caking or bituminous coals, and converting such mixture into coke by the ordinary coking operation. The coals are to be reduced to a uniform size (say a coarse powder) by crushing or grinding, or by separating the lumps therefrom by sieves or other suitable means. The mixed coals may be introduced into the ordinary coke ovens or furnaces; and the operations of charging the ovens, admitting air, &c., may be conducted in the usual way. The proper proportion of each kind of coal in the mixture may be ascertained by first mixing the two kinds in equal quantities; then if the coke, on being broken, does not present a homogeneous appearance, or is too porous, the proportions must be varied; and so on until the desired result is obtained. The patentee states that the most refractory anthracite may be used for making coke according to his invention.

He claims, the coking of non-caking coal by the mixture of caking coal,—the two sorts being intimately mixed together and the size reduced by crushing, grinding, or by abstraction of the lumps by sieves or other means.—[*Inrolled December,* 1850.]

Scientific Notices.

A PATENT AGENT'S TALE OF A REGISTRATION.

Mr. Editor,

The world has recently been treated by Mr. Dickens with *a Poor Man's Tale of a Patent*;—permit me, as a pendant to that very entertaining, if not very authentic history, to recite my experiences with respect to a *Registration.*

Unlike Mr. Dickens' hero (whose ignorance of the business he had undertaken threw him into perplexities at every stage of the patent's progress, and rendered it a marvel that he, in so short a time as six weeks, should have conquered the many difficulties which beset him), I came to my task with a firm conviction that study and experience had made me master of my subject: indeed so impressed was I with the profundity of my knowledge in this branch of the law, that I was fast approaching to the enviable state of the character mentioned by Coleridge, who used to pull off his hat with great demonstration of respect whenever he spoke of himself. I mention this fact at the outset of my story, that your readers may be satisfied,—first, that it was no incompetency of mine which drew me into the troubles which I was destined to encounter; and, secondly, that they may not be startled by any outbursts of wounded dignity which I may chance hereafter to indulge in. But to commence:—About the beginning of the month of August, 1850, I received instructions (as the representative of Messrs. Newton and Son, the patent and registration agents) to register a design for an ornamental stove, which had been prepared at the foundry of Mr. Haywood, the Mayor of Derby, and was to be secured in his name as the proprietor. This design consisted of a piece of graceful scroll-work, forming a central ornament for the lower part of the stove. In preparing the necessary drawings for registration, I thought it advisable, in addition to shewing the ornament on a small scale in its intended position on the stove, to give the details of the ornament, by shewing it detached and on an enlarged scale. The following title was also appended to the drawing:—"Design for a central ornament for a stove, to be placed as shewn in the figure below." In this form the drawings were deposited at the Registration Office on the 13th of August; and, on my messenger calling for the Registrar's certificate, he was informed that the Assistant-Registrar, the Hon. Mr. Curzon, objected

to the drawings, because they contained two designs, either of which would be received alone; but that the two together were inadmissible. To prevent any delay, I went the next morning to the office to explain to the Registrar, Mr. Johnson, that it was the application of the scroll ornament to the lower part of the stove which I wished to protect; and that it was for the purpose of shewing the ornament distinctly, as well as its position on the stove, that the two figures were given. As, however, Mr. Johnson was absent from office, I stated the case to the Chief Clerk, who re-delivered it to Mr. Curzon; but that illustrious functionary, like all truly great men, the ruling principles of whose minds are fixed and immutable as nature's laws, was not to be moved by a little verbal sophistry; the final, the irrevocable decree was therefore issued—*the registration shall not be.*

If my memory had served me to relate what followed the receipt of this decision, prudence would, I think, have kept it out of sight; for I fear I might accuse me of having called in question the wisdom of my judge, who, at a later period, I found had been a diligent student of the law, and was justly proud of his acquirements. I next made a formal demand, that the registration should be effected, and bear date on the day in which it first went into the office, in order that I might receive a written statement of the grounds on which the design was refused. The following was the reply:—

DESIGNS OFFICE, 4, SOMERSET PLACE,
August 15th, 1850.

GENTLEMEN,

In answer to your application, on the part of Mr. James Haywood, of Derby, to register an ornamental design for the centre of a stove, together with a stove on which it may be placed, but for which stove protection is not required, I am directed by the Registrar to enclose you a copy of printed "Directions for Registering," and also to state, that the copies, prints, drawings, or tracings, must consist of nothing more nor less than the *design itself* for which protection is sought.

I therefore beg to return you the drawings, as the design cannot be registered in the form now sent. On your furnishing them in the usual manner, the design will be registered, and bear the date of the day of registration.

I am, Gentlemen,
Your obedient Servant,
J. H. BOWEN.

MESSRS. NEWTON & SON,
66, *Chancery Lane.*

Was it not kind, Mr. Editor, to enclose *me* a copy of "printed directions for registering?" Oh thou good, generous, facetious functionary! to think that *I*, who had taken up the business as a profession, should require a copy of printed instructions! I who, in addition to an experience only limited by the existence of the Registration Act itself, had fairly *digested* the law long prior to thy own or thy assistant's appointment to office! I could only think of, and liken my case to Charles Lamb's, when his friend, the schoolmaster, hearing that elegant essayist complain that his little sketches were anything but methodical, and that he was unable to make them otherwise, kindly offered to instruct him in the method in which young gentlemen in *his* seminary were taught to compose English themes.

Furnished with this letter from the Registrar, I immediately prepared a memorial to the Lords Commissioners of the Board of Trade, setting forth the nature of the case in dispute, and begging that an order might be issued directing the Registrar to receive the design, and register it forthwith. This memorial, accompanied with a drawing of the design itself, was forwarded to the Board of Trade on the 20th of August; and, as no answer came, after a lapse of several weeks, Mr. Haywood, the proprietor of the design (who, by the way, exhibited the most exemplary patience throughout the whole proceeding), being anxious to know the determination of their Lordships, also memorialized the Board, with the expectation of getting an early settlement of the matter. My memorial was, however, still disregarded; and, by dint of enquiry, I discovered that the Secretary, Sir Denis Le Marchant, had resigned—that Mr. Booth had been appointed to his office—that the Secretary's table was groaning under the weight of official papers which had accumulated during the *interregnum*—and that Mr. Booth was laboring at the apparently hopeless task of disposing of this heap of neglected business. Eventually, however, after nearly two months' delay, I received a communication, which, instead of being an answer to my memorial (the substance of which, in a somewhat different shape, will be given hereafter), was little more than an echo of the Registrar's letter; and was, in fact, just such a reply as might have been expected from a person overloaded with work (as Mr. Booth then was), unacquainted, as yet, with the provisions of the Act, and glad to receive the suggestions of the party whose position would seem to entitle his opinion to respect. The following was the communication received:—

Office of Committee of Privy Council for Trade,
Whitehall, October 16th, 1850.

Gentlemen,

With reference to your letter, of the 20th August last, on the subject of the refusal of the Assistant-Registrar of Designs to receive, for registration, an ornamental centre for stoves, I am directed by the Lords of the Committee of Privy Council for Trade to inform you, that it appears, on reference to the drawing furnished by you, and on communicating with the Assistant-Registrar of Designs, that the drawing of the design tendered by you for registration, comprised, not only the ornamental design in respect of which the protection is sought, but also a drawing of a stove intended to shew the mode in which the ornamental design may be applied,—and that on this ground the Registrar declined to receive the drawing, as not being in compliance with the requisitions of the Designs Act, 5th and 6th Vic. c. 100.

The Act (Sections 4 and 15) does not require, for the purpose of registering an ornamental design, that any thing more should be furnished to the Registrar for his certificate, than a drawing of the design in question, with the name and address of the proprietor and *the number of the class* (not a drawing of one of the objects comprehended in that class), in respect of which the registration is made.

Their Lordships are of opinion that the Registrar was justified in declining to receive any other drawing than the one required by the Act to be furnished to him; and they see no reason, therefore, for their interference in the matter.

I have to express my regret that, owing to unavoidable circumstances, it has not been in my power to communicate to you their Lordships' determination at an earlier period.

I am, Gentlemen,
Your obedient Servant,
James Booth.

Messrs. Newton & Son,
66, *Chancery Lane.*

Not satisfied with this reply, which was, in fact, no answer to the case which I had drawn up, I sought an interview with one of the law officers of the Crown; and, after briefly stating the facts of the case, obtained from him what I considered a confirmation of my own opinion, but ascertained that, in his official capacity, he had no power to interfere in the dispute;—there was, however, a course open to me, as I well knew, by applying for a *mandamus*. Here, however, arose the question of *cost*; and, I may remark *en passant*, that when the proceeding was satisfactorily closed, the agent's fee would be 7*s*. 6*d*.,—a sum, the realization of which warranted little expenditure in law. But still, the point at issue was a most important one, as it involved no less a question than the sufficiency or insufficiency of the Ornamental Designs Act; the point for which I contended being, that the *application* of

an ornament to an article of manufacture was a proper subject for registration.

I must here, Mr. Editor, confess to a weakness that well-nigh overcame me: I had a great desire to go for a mandamus; it would be a novelty, a telling thing, to bring a government official to reason by force of law, and thereby vindicate the public rights. Perhaps the charm that possessed me was to emulate the acts of a near relation, who, in early life, as champion of the poor of his locality, fearlessly attacked a certain Honorable Society of lawyers, and forced them to compromise the matter by a large annual tribute to the pauper fund; and who, on another occasion, drove his rector into the Court of Chancery, to shew his right to tithe his parish; and, after years of disputation, effected the exemption of a large part of the locality from that burden. But, whatever was the impelling power, it was eventually restrained by prudence; and, keeping the mandamus course in reserve, I sought other means to carry my point. With this view I requested, and obtained, an interview with Mr. Booth, when I entered at great length into the case, and shewed that the Registrar's decision, if maintained and acted upon, would exclude about three-fourths of the designs offered for registration. Here, however, though I believe my statement had carried conviction, I could meet with no redress; for I was informed, as, indeed, I was before well aware, that Mr. Booth had no power to compel the Registrar to act contrary to his judgment,—that, in fact, he doubted whether the Board of Trade had the power to do what I required,—but that, if I obtained an audience of the President of the Board of Trade, I might, perhaps, be satisfied on this point. I did not think it well to trouble Mr. Labouchere on this matter; but I reserved this course also, intending, if occasion should require me to adopt it, not to confine myself to the question now in hand, but to bring forward other little matters which I had noted down from time to time.

My next step was to wait upon Mr. Johnson, the Registrar, and to put him into possession of all the facts of the case. This I did; and, having satisfied him that there were points that ought, without delay, to be definitively settled, he proposed that I should draw up a paper, embodying the various points that had been raised, and it should be commented upon by him, and both statements should be submitted, through the Board of Trade, to the Attorney-General for his opinion; and that he, the Registrar, would be bound by that decision. I immediately closed with this fair proposal, and, without loss of time, prepared and sent in the following letter, which is an echo of the memorial transmitted to the Board of Trade:—

66, CHANCERY LANE,
Nov. 4th, 1850.

SIR,

In conformity with your suggestion for determining the unsettled points of practice raised in consequence of the refusal of the Assistant-Registrar to receive and register an ornamental design for a stove (in the form in which the papers were prepared), I beg to lay before you the following statement, in order that it may, together with your remarks upon it, be fairly weighed by some competent legal authority, and thereby draw forth the expression of an opinion, which may not only form a guide for the future practice of your office, but also afford the public a reliable interpretation of an Act which has hitherto been strangely misconstrued. With this view then I will enter, not merely upon the point on which the memorial to the Lords Commissioners of the Board of Trade was framed, but also upon two correlative points which were raised while discussing the matter with Mr. Booth:—And 1st, In the 3rd. Sec. of the Designs Act, 1842, it is stated, "And with regard to any new and original design * * * whether such design be applicable to the ornamenting of any article of manufacture * * * and that whether such design be so applicable (1st) for the pattern, or (2nd) for the shape or configuration, or (3rd) for the ornament thereof, or (4th) for any two or more of such purposes * * * be it enacted, &c., that the proprietor of such design shall have the sole right," &c.

It is therefore evident, without in the least straining the meaning of the words, or breaking them up by an arbitrary division, that four distinct kinds or classes of ornament fall within the scope of this Act, viz.:—

I. A pattern *per se*, whose application may be various and extensive, as that of a scroll, or piece of fretted work.

II. An article of graceful shape, or configuration, but devoid of decoration, as a plain Grecian or Etruscan vase.

III. An ornamented article, the basic form of which has no pretension to elegance or novelty,—as the stove in question.

IV. An article of graceful shape decorated with a pattern, as a vase, festooned with flowers, or encircled with figures.

Such being the nature of the Act, it will be readily seen what is the value of the Assistant-Registrar's objection, that "the drawings must consist of nothing more nor less than the design itself for which protection is sought;" for it is obvious, that if in the design in question the new part of the stove had not been pointed out, the registration would have been invalid, from want of novelty in the arched shape or configuration of the stove, which, from implication, would have formed a part of the design. But, if we are compelled (as suggested at the Registration Office) to register the central ornament irrespective of the stove, what becomes of the third kind of design, as pointed out above, and referred to in that part of Section III., which sets forth the

duration of protection in the following words:—"In respect to *the application of any such design to ornamenting any article of manufacture* contained in the first, second, third, fourth, fifth, sixth, eighth, or eleventh, of the classes following, for the term of three years?"

Again, in Section IV. it is said, that "no person shall be entitled to the benefit of this Act, with regard to any design, in respect of the application thereof to ornamenting any article of manufacture * * * unless, at the time of such registration, such design have been registered in respect of the application thereof to some or one of the articles of manufacture or substances comprised in the above mentioned classes." But, inasmuch as the grant of protection for ornamenting articles, which of themselves are inadmissible under this Act—from having either no pretension to novelty, or else no novelty of form—is one, if not the chief object of this Act, I maintain that the application of an ornament to an article of manufacture, is a legitimate subject for registration; and further, that the designer of a decoration has not merely a right to register such decoration *per se*, as an ornament, but also to register it in combination with the article ornamented,—and that, in such a manner, as to distinctly shew what is, and what is not, the subject matter of the registration.

2nd. The Registrar, under the Act 5 and 6 Vic. c. 100, Section XV., is empowered to refuse to register ornamental designs "unless he be furnished * * with two copies, drawings, or prints, of such design, accompanied with the name of every person who shall claim to be proprietor * * * with his place of abode, or place of carrying on business, and the number of the class in respect of which such registration is made;"—that is, three provisos must be complied with before an applicant for a registration has any right to have his demand considered; but when these provisos are complied with, the Act says, "*the Registrar shall register all such copies, drawings, or prints, from time to time, successively, as they are received by him for that purpose.*" I maintain, therefore, that the act of the Assistant-Registrar, in refusing to register the design in question (for the cause assigned), was an illegal assumption of authority.

3rd. Under Sec. XIV., provision is made that the Lords Commissioners of the Board of Trade and Plantations, may appoint a registrar of designs, and likewise a deputy-registrar, clerks, &c., who "shall hold their offices during the pleasure of the Lords of the said Committee;"—and further, "the Lords of the said Committee may make rules for regulating the execution of the duties of the office of the said registrar." I therefore maintain, that power is vested in the Board of Trade to enforce the observance of the statute by the officers of the Registration Office.

I am, Sir,

Your obedient Servant,

CLEMENT JOHNSON, Esq. A. V. NEWTON.

Now, whether the style of this letter was unpalatable to the Registrar, or his evil genius had been at him, I know not, but after the receipt of my communication, he certainly became very captious. The generous spirit in which he offered to resign his imperial powers, and submit to the dictates of a common Act of Parliament, never returned;—my statement was not suited to be laid before any counsel. It was in vain that I expressed my willingness to abide by the decision that would be given on the case, as stated; for, backed as he now was, during this and all following interviews, by the Assistant-Registrar—that inexorable judge, who had raised my wrath at the outset—my word could prevail nothing. At last I requested to know in what form he would receive my statement. The case must come in the form of a legal opinion, if I could find some counsel to back my views; but he must be a man of standing at the bar. I mentioned several as conversant with the subject, and begged the Registrar to choose his man. This he declined to do; and I selected Mr. Webster, who, after hearing a brief statement of the case, wrote the following opinion:—

TEMPLE,
November 20th, 1850.

The subject matter of registration under the Designs Act, 5 and 6 Vic., c. 100, is the application of designs to articles of manufacture. Many cases may occur in which the design, in the abstract, so to speak, may have been well known; but its application to the particular article of manufacture being new, it may become the subject of registration. Cases will also occur in which the situation of the design upon, or in combination with, the article of manufacture, is essential to be pointed out. In such cases more or less of the article must be exhibited, though nothing be intended to be claimed in respect thereof. A change in the situation or arrangement of a figure or group of figures on the same article of manufacture, may constitute different subjects of registration. The addition of a well known scroll to the front of a grate constitutes a new design of such front; the author has a right to treat the whole, with such addition, as the new design, if inclined so to limit and restrict his claim. The words of Sec. XV. (5 and 6 Vic., c. 100), as to registration of the design, do not qualify or explain the subject-matter of registration as previously defined. The words "such design" must be referred to and read in connection with the words "any design in respect of any application thereof, &c.;" and I am of opinion that the registrar has no discretion as to the registration. The words are, "he shall register;"—there is nothing constituting him a judge of the sufficiency of the drawings furnished: if they exhibit an article of manufacture, ornamental in character, the requisites

of the statute are complied with.—If the claim be too extensive, registration will be void for want of novelty in the design.

THOMAS WEBSTER.

Fortified with this document, I ventured to appear again before the brace of self-appointed judges; and, presenting the paper, was informed, after a cursory glance at it, that this would not help me;—it did not meet the requirements, &c. I suggested, that a careful consideration of its contents might be a prudent course—that I was led to expect a quiet settlement of the question; and perhaps it would be as well not to baulk my expectations. You will perceive, Mr. Editor, that I was now preparing for a plunge into the Rubicon. As the discussion proceeded, the question had changed from a personal to a public one; private pique was absorbed in the growing desire to vindicate a public right. In fact, the inverse of Emerson's dogma—"Every experiment, by multitudes, or by individuals, that has a sensual and selfish aim, will fail"—was now to be tried; and I waited patiently the cue to commence the contest. The storm, however, blew over; and my statement, accompanied by Mr. Webster's opinion (and, doubtless, the Registrar's comments), was forwarded to the Board of Trade, to be thence referred to the Attorney-General. An attempt was here made to compromise the matter; and to this I very reluctantly agreed, naturally anticipating a repetition of the annoyances which I had so frequently suffered; but the arrangement was overruled, as I suppose, from the Registrar (who had now brought himself to believe that his case was a strong one) refusing to concede anything for the future;—the opinion of the law officers of the Crown was therefore taken. The result will appear from the following communication from the Registration Office, the tenor of which is somewhat different from the previous letter received from that quarter:—

DESIGNS OFFICE,
January 17*th*, 1851.

GENTLEMEN,

With reference to your memorial to the Board of Trade on the subject of the refusal to register the accompanying "Design for an Ornamental Centre for Stoves," I am directed by the Registrar to inform you, that he has received the opinion of the Law Officers of the Crown, an extract of which is annexed,—and to state that, as it is considered a fit subject for registration, he is prepared to register the same.

I am, Gentlemen,
Your obedient Servant,
J. H. BOWEN.

Messrs. NEWTON & SON,
66, *Chancery Lane*.

Extract from the opinion of the Law Officers of the Crown.

"We are of opinion that the Registrar is bound to receive and register every thing which is directed to be registered by the 3rd Section. We think when, as in this case, the design is registered in respect of its application to the ornamenting of some of the articles of manufacture, the drawing *may, and properly* OUGHT to shew the application of the design sought to be registered."

Surely this can require no comment. After rather more than six months' delay, Mr. Haywood is permitted, through the intervention of the Attorney and Solicitor-General, to register his design agreeably to the provisions of the Act,—that is, in respect of *the application of the design to ornamenting an article of manufacture;* and I am allowed to earn my fee of *7s. 6d.* You will perceive there is now no mention made of enclosing me a copy of "printed directions for registering." It is my turn to play the schoolmaster; but I refrain, from respect to the feelings of the Registrar and his Assistant, who, if for once they have mounted the wrong horse, are already sufficiently convinced of their error. And further, as the intelligence and firmness which they have in general shewn in the execution of their arduous duties will, doubtless, point them out to government as fit persons to fill the more responsible posts which the contemplated alterations in our patent laws must necessarily create, I may find it to my advantage that, while holding in my hands the power to persecute, I acted most leniently towards those gentlemen.

I am, Mr. Editor,
Your obedient Servant,
A. V. NEWTON.

ON THE ODIC PRINCIPLE OF REICHENBACH,*

AND THE RELATION IT BEARS TO THE IMPONDERABLE BODIES OF IGNOTUS.†

THE researches of the Baron Von Reichenbach have led him to maintain the existence of an hitherto undiscovered principle, which he has termed *Od*, or, as referring to its agency, *the odic*

* Physics.—Physiological Researches on the Dynamics of Magnetism, Electricity, Heat, Light, Crystallization, and Chemism, in their relations to Vital Force; by BARON CHARLES VON REICHENBACH. The complete work from the Second German Edition; with the addition of a Preface and Critical Notes, by JOHN ASHBURNER, M.D. Part I., 1850; Part II., 1851.

† On the Nature and Operations of the Imponderable Bodies, by IGNOTUS; in the London Journal of Arts, Sciences, &c., Vol. XXXII., from February to July, 1848.

force. This principle he regards as common to *all* bodies, and capable of emanating from them in such manner as to produce a variety of demonstrable effects: unfortunately, however, his demonstrations have only been acquired through the media of extraordinarily sensitive persons; by far the larger portion of mankind being utterly incapable of detecting them, and who, consequently, (and particularly those who worship the exact sciences) are disposed not only to refuse assent or credence to their truth, but to regard them as grounded on error and misconception, or as the results of speculative enthusiasm, or a deranged imagination; nay, the work has been designated as "an absurd romance," and "one of the most melancholy aberrations which have, for a long time, settled on a human brain;" and yet no one, who has carefully perused it, can pretend to deny that its talented author has conducted his experiments with anxious caution, or drawn his inferences therefrom otherwise than with logical reasoning and strict scientific integrity.

The earlier researches and experiments of Von Reichenbach were conducted through the media of a number of sickly sensitive females,—of the class which may be termed highly nervous, cataleptics, somnambulists, and clairvoyants; the whole of whom concurred in stating that, when in the dark, they saw the odic phenomena issue from the extremities and surface of magnets, in the form of luminosity, exhibiting a variety of colors, but more commonly affecting a bluish tint.

Other effects were, however, described;—namely, peculiar sensations of warmth or cold,—or of a pleasurable or painful feeling; the latter extending occasionally to shuddering or even convulsion, according as the different poles of the magnet were brought into proximity with the hands or other parts of the bodies of the parties operated on.

In his further investigations, Von Reichenbach, assisted by numerous admirably conducted experiments, detected correspondent effects from a variety of sources distinct from the magnet, and, particularly, from the poles of crystals; from the human hand; nay, emanations of *od* from all parts of animal bodies; from the solar and other celestial bodies; from heat, radiant or conducted; from friction; from flames; from chemical decompositions; from electricity; and, in short, from the whole of the material world in general.

The Baron endeavours to prove that the odic force evidences wide distinctions from magnetism, electricity, and heat—points to be hereafter more fully considered. It is a motive power, capable of passing from its various sources into other bodies, and of being accumulated in them: in the latter respect he found that water as well as other bodies could be charged with odic matter; and which, according to their nature, retained that charge for a greater or lesser time,—"the capacity for a charge being generally satisfied in a few minutes." The odic matter also ad-

mitted of transference from, passage through, or conduction from all bodies in general; in fact, nothing, even thick brick walls, prevented this effect: it was nevertheless subject to a degree of arrest, according to the nature, density, or constitution of the bodies conducting it. Its travelling power consequently varied from the velocity of light, magnetism, or electricity;—paper, wool, or wood, rendered the passage difficult; but glass and silk were comparatively perfect conductors. The Baron infers (p. 98,) that matter possesses a certain coercive power with respect to *od*, but only for a limited time; and also a power of conducting it in different degrees in proportion to the continuity of bodies.

The Baron's general creed respecting his odic principle may be collected from the following passages of his work. He says, "a peculiar hitherto overlooked force resides in matter" (p. 60). This force, or the light, or flame, resulting from it, is "something evidently material" (p. 28); it is "a perfectly universal and all-pervading force of nature," and extends "over the universe" (p. 222).

Although the annunciation of this new force was received with suspicion and incredulity by a large majority of the investigators of nature, there was one class of physicists who hailed it as a God-send—the Mesmerists; to them it appeared as a true embodyment of the essence of their peculiar science; and yet Reichenbach himself was no mesmerist; on the contrary, although he regards his odic force as explanatory of whatever may be true in that category, in some passages he treats both mesmerism and the system of Gall, with sneering contempt; and when speaking of the former he generally designates it as "the so-called animal magnetism." In fact, his ardour for chemical science at once justly led him to ascribe the phenomena of *odism* to chemical actions occurring by virtue of a new imponderable element, capable of being eliminated by means of chemical action; a view in which some of the leading mesmerists are not indisposed to coincide, as may be collected from the remarks of one of his learned English translators, Dr. Ashburner, appended to the 2nd part of the original work (p. 438 to p. 470), and who appears to have engrafted his view on the opinions of Ignotus respecting the chemical nature of the principle of light—or *lumine*.

The second portion of Von Reichenbach's work, more recently published, is principally intended to afford additional illustrations of the doctrines previously advanced. One very important feature of it is, that, whereas his first experiments were almost entirely conducted by means of sickly sensitive persons, they are here corroborated by numerous healthy individuals. It is not without apparent exultation that the Baron furnishes a list of more than fifty new witnesses of the perception of the various odic phenomena, differing in sex, age, residence, position in life, and occupation; some of the highest respectability, and from the

rank of nobility; others men of medical and other professional attainments, and many of them in the most perfect health. Amongst them he particularly mentions a Mr. Anschütz, an artist, whom he describes as "a healthy vigorous man, 35 years of age, thoroughly inured by a thousand hard marches and dangers during his former military life, who had never suffered from real illness; of moderate stature; very muscular," &c., &c. (p. 326.) This gentleman not only saw all the odic luminous phenomena, but was enabled to give admirable graphic representations of them, some of which are introduced into the work. The Baron consequently infers that "every pretext against the reception of my observations is now for ever removed through Mr. Anschütz." Doubtless, however, many will, notwithstanding, aver that Mr. Anschütz may be a wild enthusiast—or an impostor. When, however, the whole concurrent testimony which the evidently honest Von Reichenbach has brought forward, is taken into account, such an inference is, to say the least, uncharitable; and although the author of the present paper is himself neither mesmerist, nor a positive believer, and has never been able to elicit odic phenomena, he does think it not improbable that some subtle principle, analogous with what the Baron has advanced, may exist in nature.

Admitting the above probability, and suspecting that a strong analogy, if not identity, may exist between the odic force and the magnetic hypothesis of Ignotus, and with a view of attempting to reconcile the two so as to bring them under one and the same category,—the present paper is offered to the readers of the Essay of Ignotus.

In pursuing this object, it will be necessary to state briefly, the leading features of the hypothesis of Ignotus, at least as far as they relate to the point at issue.

Ignotus has maintained that there exist in nature three imponderable bodies—magnetine, lumine, and calorine; and that these are all *imponderable* chemical elements, capable of entering into chemical combination with all the acknowledged *ponderable* chemical elements and their compounds, so as to be essential constituents in them, and existing, as such, in a latent state. Whenever any body, in which they may thus exist, is subjected to chemical action or decomposition, these imponderable matters are capable of disengagement; in which case, they admit of being set at liberty in what may be termed a free or native state, so as to manifest their own respective active and peculiar properties: thus magnetine becomes the cause of magnetic phenomena—lumine of light—and calorine of sensible heat;—from which conditions they may enter into combination with other bodies, and again become latent. The process of combustion affords an instance of these effects. But perhaps the more important application of the principle brought forward by Ignotus, is the elimination of magnetine in the brain, from arterial blood previously

highly charged with magnetic principle by means of the processes of digestion, nutrition, and sanguification. In this respect, he has aimed at a development of the nature and sources of vital action.

Another important point in the views of Ignotus, as bearing on the present subject, relates to the nature of that species of electricity produced by the ordinary frictional apparatus; the phenomena of which he considers, not as the results of any one fixed principle in nature, but as a mere effect or manifestation of a chemical action, induced in the decomposition of a particular and well known ponderable matter—oxygen, constituted, as he believes, of magnetine, and a new ponderable chemical element, which he designates as *electrine*. In this decomposition electrine is separated, so as to form the positive, and magnetine the negative electricity;—a subsequent re-union of the two elements giving rise to the more familiar and active phenomena involved in what is termed the electric shock.

Various modifications of the above principles, or their effects, are adverted to in the Essay of Ignotus, which it is unnecessary here to detail, the above being sufficient for the purposes of the present paper.

Having premised thus far, we now revert to the opinions of Reichenbach.

Reichenbach is fully alive to the possibility that od and magnetism may eventually prove to be identical (p. 298); he nevertheless dwells on the manifest distinction which their respective phenomena present; as well also as those afforded by heat and electricity; and this with the view of shewing "whether or what hope exists of bringing them into already known categories." It is purposed to enquire into the general principles on which his arguments rest, and the relations they maintain with the views of Ignotus.

SEC. I.—*The distinction between od and heat.* (*Reichenbach, p.* 299.)

Odic emanations do not effect the thermometer; on the contrary, the two cause diametrically opposite effects:—they are far more conductible by metals than heat is, and more penetrable through solid bodies; they do not alter the density of bodies like heat. From these and other reasons, Reichenbach affirms that "heat must be fundamentally different from od" (p. 301).

It is unnecessary to comment on the above;—if the matter has any relation to the views of Ignotus, it is only in a confirmatory sense, inasmuch as he regards the principles of magnetism and heat in the light of totally different elements, and antagonistic to each other. As future consideration will rest the basis of *od* on magnetine, it follows that he can in no respect dispute the Baron's inference of *od being distinct from heat.*

SEC. II.—*The distinction between od and electricity.* (*Reichenbach, p.* 301.)

This consideration is more important than the preceding one; as, notwithstanding Reichenbach infers that "the gap which separates them is very great" (p. 305), yet electrical phenomena rarely if ever exist without odic ones being, at the same time, manifested; although the latter, he says, "very often occur when electrical phenomena either do not exhibit outward manifestations, or, as far as we know, do not at all exist" (p. 301). Various other distinctions are indicated, which chiefly refer themselves to the differences in the distribution, or conduction, or the accumulations of the two in respect to other bodies; as well as to the sensible effects induced on sensitive persons. Od, for instance, pervades all bodies, and distributes itself throughout their mass; while electricity lies only on the surfaces of bodies. Od is capable of being much longer retained by bodies charged with it; so that, in fact, it appears to have a considerable attraction for their molecules, and, in its movements, to travel much more slowly—in some instances, a million times more slowly than electricity. Od travels through all bodies in a ratio proportionate to the greater or lesser continuity of their particles; while electricity is only well conducted by metals, and, by many bodies, not at all. Electric actions manifest themselves instantaneously; od requires an evident lapse of time to be recognized, and its duration is incomparably longer. Od can be accumulated on unisolated bodies; electricity only on isolated ones. There are other differences urged by Reichenbach, but of minor importance.

It would appear, from the above statement, that the differences between od and electricity mainly refer themselves to the facility of movement, or the greater or lesser rapidity of transit of the two respectively, when passing through other bodies: at the same time sufficient reason is given to justify the inference, that od is a matter *sui generis,* possessed of properties peculiarly its own. That this matter is not analogous with the principle of light or lumine, as Dr. Ashburner is inclined to infer, is evidenced by the fact, that the movements of the latter are not less rapid than those of electricity or magnetism themselves.

An attempt will now be made to shew how far the views of Ignotus apply themselves to the differences exhibited between od and electricity.

It is to be borne in mind that, according to Ignotns, electric actions are induced, primarily, by the decomposition of oxygen into its constituents, electrine and magnetine; and, secondarily, by the two elements entering again into union. It is to the latter that some of the more important of the phenomena are attributed, as instanced in the discharge of the Leyden jar, in which the subtle element magnetine is regarded as the more energetic agent in producing the electric shock. Hence the principal and most

interesting manifestations, and those to which Reichenbach applies his enquiry, are virtually *of a true magnetic character.* The electrine itself, although doubtless an important and energetic agent, is of a far grosser nature, impenetrable through various bodies which magnetine readily permeates—particularly glass, but capable of readily passing through others, as metals: in consequence of these properties, it admits of isolation and accumulation by means of its impenetrables or non-conductors, as they are called, whereas magnetine cannot be isolated by any body.

In the above state of isolation, in which it may be regarded as existing in its native condition, electrine has a powerful affinity to combine with magnetine, and form a magnetide of electrine, or oxygen,—by virtue of which affinity, whenever the isolating restraint is removed (and which, in the Leyden jar, is effected by applying the metallic conductor), magnetine rushes from the exterior into rapid combination with the electrine in the interior. The reason why, in this experiment, the isolation continues until the conductor is applied, is given in the Essay of Ignotus. If such cause of continued isolation or constraint did not exist, the magnetine in the immediate vicinity of the jar would doubtless at once produce the combination; as is frequently experienced from overcharging the jar. Under this view the electricity of Reichenbach is a manifestation of true magnetic principle, and as such will be further considered in the succeeding section. *In itself it is not a principle, but an effect or phenomenon, and therefore is not od.*

With respect to the element electrine, it admits indeed of accumulation, and from its nature is necessarily possessed of slower velocity of transit, and therefore exhibits a degree of correspondence with the odic force; its strong tendency to combine with magnetine and become neutralized the moment it ceases to be subjected to restraint, however, shew it to be essentially different from the odic force—*od, therefore, is not the electrine of Ignotus.*

Sec. III.—*The distinctions between od and magnetism.* (*Reichenbach, p.* 305, &c.)

It is important to observe upon this head, *in limine*, that the magnetism to which Reichenbach has applied his observations is, almost exclusively, of that kind or modification which manifests itself by circulation in closed currents, and through the ferruginous apparatus termed magnet. He admits, it is true, that "it gives tokens of its presence in the rays of the sun and moon, but in so weak a degree that its presence is highly doubtful." The magnetine of Ignotus is, on the contrary, a general principle pervading all nature, and especially emanating from the solar orb, as well as from all bodies from which it admits of being eliminated, from a latent into a free state, by virtue of chemical action; in which case, whenever it is not subjected to a ferru-

ginous channel, it evidences few if any of the phenomena of the magnet. Taking the magnetism of Reichenbach in the above sense, he has laboured hard, and with apparent success, to shew that its phenomena are very distinct from those of od; notwithstanding, he admits that "magnetism never occurs alone, but always associated with od" (p. 305); but, on the contrary, he adds that "od is formed or manifested visibly in a number of cases where magnetism never gives evidence of its presence."

The Baron communicates the following essential differences between the two:—od may be transferred on all matter; magnetism only to a certain few bodies. Iron in the minutest form, and most delicately suspended, is not attracted by od as it is by magnetism. Od may be refracted by a glass prism; a property wholly wanting in magnetism, which is not arrested by anything; neither can it be deflected. Od may be distributed through the whole mass of bodies, as water; but magnetism is restricted to the surfaces of bodies. Suspended odic bodies do not acquire any particular direction from the influence of terrestrial magnetism, which turns magnetic bodies into the meridian. Magnetism will penetrate every thing, whereas od may be excluded from some bodies.

Many additional instances are adduced; some of them too intricate for consideration in this place.

The magnetism, or magnetine, of Ignotus, certainly maintains important differences from the magnetism of Reichenbach; some of which have recently been alluded to. Whether it be eliminated from the magnet, electrical action, voltaism, or any other source, including the solar rays, it is to be regarded as a peculiar homogeneous imponderable matter, possessed of powerful chemical affinities, and capable of exerting in either a free or latent state; and differing, when in the free state, in its effects or phenomena according to the apparatus or circumstances by which it is evolved. One of its peculiar properties is, that when moving in a free state from the solar orb, it admits, like od, of arrest and refraction,—giving rise to colorific effects. It is therefore probably not perfectly immaterial or imponderable,—since it appears to meet with more or less opposition in its passage through the pores of certain bodies.

It may be desirable to make a few additional observations on the modifications of effects produced by the passage of magnetine through peculiar apparatus, or under peculiar circumstances. When passing through the pores of ferruginous matter, in consequence of the opposition it experiences therefrom, its phenomena are those manifested by the true magnet: when through the pores of other metallic bodies, the pores of which are presumed of different construction—if the quantity transmitted be considerable, it may evidence somewhat analogous effects, although they are temporary, ceasing as soon as the supply diminishes,—notwithstanding a silent diffusion into neighbouring bodies may

continue for a short time, or, until the magnetic constitution of the whole has attained a state of equilibrium. These latter effects are instanced in the voltaic apparatus, a current from which passes off with greater or lesser rapidity, according to the extent of the exciting chemical action. In what is termed electro-magnetism, if the current be made to pass through the conducting iron, formed into a helix, surrounding a body of soft iron, so large a quantity of magnetine escapes through the lateral pores of the helix, as to render it a true magnet. In the eliminations or transmissions of the solar rays, although the passage be rapid, and its vibrations sufficient to produce eventually the phenomena of light, yet, meeting in their transit with little or no ferruginous matter, few if any of the phenomena of the true magnet are induced.—Yet, in all these cases, magnetism is the essential agent.

The tardy movement of the odic force, so different from the inconceivable rapidity of that of magnetine, is, however, a sufficient evidence of the distinction between od and the magnetism of either Reichenbach or Ignotus.

[*To be continued.*]

NEW PROCESS FOR PRESERVING ANIMAL AND VEGETABLE MATTERS.—BY M. ROBIN.

[Translated for the London Journal of Arts and Sciences.]

An extensive series of experiments has proved that artificially-formed volatile compounds, consisting either entirely or principally of carbon and hydrogen, constitute an especial class of agents, capable of neutralizing or destroying the influence of oxygen and moisture, and, consequently, of preserving animal substances from putrefaction, in spite of the presence of oxygen.

In the list may be placed sulphuric ether, chloroform, naphththa, oil of coal-tar, either crude or rectified, oil of schist, acetic ether, benzin, naphthaline, oil of spirit of wood, caoutchoucine, volatile oil of potatoes, essence of bitter almonds, and, lastly, hydriodic ether.

Animal substances immersed in these liquids undergo no putrid change, and the vapors of the liquids are equally energetic in their antiseptic action. Pieces of meat placed in a close vessel, in the bottom of which was a sponge saturated with one of the above-named antiseptic agents, retained the blood which remained in them when first cut off the animal, and manifested not the slightest trace of putrefaction;—and, after the lapse of eight months, pieces of half a pound in weight were found in a perfect state of preservation, after having been enclosed in stoppered bottles containing sponges saturated with sulphuric ether, chloroform, or oil of coal-tar. During the whole of this time the meat was only exposed to the vapor of the fluid, which formed an antiseptic atmosphere in the bottles; but when immersed in water saturated with the vapor, the preservation seemed to be equally perfect.

Arguing from analogy of chemical composition, from which the existence of similar properties may fairly be inferred,—a second class of bodies has been discovered, which possesses in a high degree the anti-putrescent power;—these are the binary compounds of carbon with the other metalloids. Besides hydrogen, it has been ascertained experimentally that the sulphuret of carbon, protochloride of carbon, carburet of nitrogen, Hollands spirit, and hydrocyanic acid, are, as well as the hydrocarbons, powerful preservers of organic matter. The vapor of these different compounds, disengaged at the ordinary temperature of the air, in close vessels, will preserve, for an indefinite period, animal substances enclosed in them;—this effect is produced in even a stronger degree, as would indeed be naturally expected, when the organic matter is immersed in the fluid.

It is not, however, sufficient that an antiseptic fluid should preserve the form, volume, and consistence of animal substances; in some cases, as, for instance, in the preservation of anatomical specimens, it is equally necessary that the color of the object should be retained: with respect to this, chloroform, proto-chloride of carbon, and rectified oil of coal-tar, are much superior to the antiseptic substances ordinarily employed; but all these are far surpassed by hydrocyanic acid. From the moment in which the vapor of the acid becomes diffused through the atmosphere of a close vessel, all putrefactive action is at an end—the animal matter remains permanently in the state in which it is first subjected to the action of the acid—there is no further alteration, either in its color or in its physical properties. Pieces of flesh, suspended in stoppered bottles, in the bottoms of which were sponges, saturated respectively with hydrocyanic acid, maintained, at the expiration of eight months, all the freshness of appearance and general external characters which they possessed at the commencement of the experiment. Further trials have, however, shewn that, taking into consideration lowness of price, intensity of power, and rapidity of action, there is no substance among the hydrocarbons and the analogous compounds of carbon with the other metalloids, equal, as an antiseptic, to the oil of coal-tar. The vapor which arises from a sponge, saturated with this fluid, will preserve, for a very long period, with its form, volume, and flexibility, complete, and of a fine red-brown color, animal matter, suspended in a closely-stopped bottle. None of the fluids of the flesh escape, and it can be removed at pleasure from the vessel, for the purpose of study or dissection. Animal matter, which from immersion or exposure to the vapor of the oil of tar for a sufficient time to absorb that substance, is rendered incapable of undergoing putrefaction in the air, if removed from the preserving fluid, and exposed to the air, will become as hard and dry as a piece of wood; but, if kept in a close vessel, so that evaporation cannot go on, it will retain all its volume, softness, and flexibility. Rectified oil of coal-tar offers this advantage over the crude oil; it

does not alter the color of the specimens, but maintains in them a very remarkable appearance of freshness; so that, although it is somewhat more expensive, it ought always to be employed where it is desirable to preserve the color of the object as nearly as possible in its normal state.

If it be necessary to expedite the action of the antiseptic agent, it may be done by accelerating the evaporation of the latter by applying a moderate heat to the vessel: by this means the vapor will be more dense and penetrating. It is not improbable that the oil of coal-tar, in its crude state, may be employed with advantage in embalming dead bodies, and in their preservation for the purpose of dissection in the medical schools; in the tanning of leather, and in the preparation of that kind of leather termed "russia leather;" in the destruction of the insects which attack collections of objects in natural history; in the preservation of wood, and of cerealio and all other kinds of grain.—[*Comptes Rendus.*]

ON THE CHEMICAL COMPOSITION OF THE AIR.

BY M. LEWY.

FROM the month of March, 1850, M. Lewy was continually engaged in the analysis of the atmosphere in the town and neighbourhood of Santa Fe de Bogata, in the Republic of New Granada; and some extraordinary results have been attained through these experiments with respect to the quantity of carbonic acid which the atmosphere contains. In August and September as much as 47 parts of carbonic were found in 10,000 parts of atmospheric air; whilst in the months of March, April, May, and June, not more than 3 or 4 parts of carbonic acid could be obtained from the above quantity of air.

The experiments were quite trustworthy, and were performed by the best methods to ensure exactness.

The experiments on the atmospheric air collected at the surface of the Atlantic Ocean during the voyage have also led to the discovery of a new and apparently very general fact (for it was found in every one of the analyses), viz., that air, thus collected from over the sea, contains a larger proportion of oxygen and carbonic acid during the day than in the night. It does not appear that this fact had been before ascertained; but all the analyses in this case, without a single exception, confirm it. There was invariably found more oxygen and more carbonic acid in the air collected during the day than in that during the night. The difference was more decided when the sky was clear than when it was overcast. The two following are analyses of air collected over the sea at a great distance from *terra firma*:—

18th Dec., 1847.—3 o'clock in the afternoon; fine weather, a strong breeze from the east, temperature of the atmosphere 24° Cent., 21° 9′ north latitude, 42° 25′ west longitude.

4th Dec,, 1847.—3 o'clock in the morning; wind north west,

fine weather, strong breeze, temperature of the air 13° Cent., north latitude 47°, west longitude 13°.

Composition of the air in volume.

	Oxygen.	Nitrogen.	Carbonic Acid.
18th Dec.—Day ...	21·05973	78·88637	0·0005390
4th Dec.—Night ...	20·96084	79·00660	0·0003336

It will be seen that the difference is very appreciable. In performing the analysis with the endiometer of M. Regnault, it is believed $\frac{1}{10,000}$ of volume could be readily detected.

The extraordinary quantity of oxygen contained in the atmosphere (overlying the sea) during the day, may, perhaps, be explained, by supposing that the sun, in heating the surface of the sea, causes the disengagement of the air dissolved in the water, and which is very rich in oxygen, more so than atmospheric air: it may be thus conceived, that the layer of air in contact with the water would become appreciably affected in its composition.

ON THE CHEMICAL CONSTITUTION OF METALLIC ALLOYS.

BY. M. A. LEVOL.

From the labors of M. Levol, in the department of chemistry above mentioned, the following important deductions have been made:—

That silver and copper are capable of forming a definite compound or alloy, composed of 718·93 parts of silver to 281·07 of copper;—the formula of this compound being Ag_3Cu_2, and its essential character (like that of all true chemical compounds) a perfect homogeneousness of texture and appearance.

All the alloys of silver and copper, besides the one just described, must be regarded as mere mixtures of the metals, in which either the silver or copper is in excess, according as they vary from the proportions laid down.

That alloy, or rather definite compound, in which the standard of silver is represented by 718·93, appears to be the one to which other alloys of silver and copper ought to be referred. Other alloys experience, at the moment previous to solidification, a very remarkable liquation, which it has been hitherto found impossible to prevent: thus an alloy, containing of silver 900, cast in a spherical form, will give, on analysis of its exterior parts, a composition shewing 2·39-thousandths above its original standard; and, on analysis of its central part, 8·36-thousandths below that standard.

This circumstance gives rise, in the working of alloys of silver and copper, to many serious practical difficulties, which are felt, not only where masses of metal are cast, as in ingots, but also in the manufacture of coin: although, in reference to the latter, the limits of variance are narrow and, empirically, means are found to bring the standard to a close average. The composition

of each piece of money, such, for example, as a five-franc piece, approximates very closely to the normal standard of 900-thousandths of silver; but each piece is produced from a sheet of alloy, which gives about 40 pieces; and it has been proved that, between one end of the sheet of metal and the other, a very notable difference really exists. It, therefore, necessarily follows, that each piece of money, cut from the sheet of alloy, must vary, more or less, in composition.

The following experiments, made on sheets of alloy intended for the manufacture of five-franc pieces, prove the truth of the above doctrine:—

The sheets of alloy mentioned are 50 centimetres in length before being passed through the flatting-rollers. After this operation, when rolled down to the proper thickness, their length is increased to 1¾ metre; and they furnish 40 discs of metal,—each being afterwards converted into a piece of money. These discs were subjected to analysis, individually,—the whole 40 being examined: the first corresponded to the head of the sheet whence it was cut; the last to the other extremity. The difference in the composition of these two, represented the gross difference between the two extremities of the sheet; and this was found to amount to above 3-thousandths in the quantity of silver.

The possible consequence of this state of things is, that if by chance the estimation of the standard value of French money were made upon pieces cut entirely from the head of the sheets (taking the lowest normal standard as 898·896-thousandths), that standard would be judged of at 900·44, or 1·54-thousandths above its proper value; while if, on the other hand, the estimation were made upon pieces obtained from the opposite extremities, it would follow, that the money would be judged 1·59-thousandths below its real value.

What is to be opposed to this difficulty, as injurious to the interests of the directors of the coinage as to those of the public—as much beyond the control of the exactness of assayist as of the other methods employed to ascertain, with precision, the standard of every individual piece of money? Would it be possible to introduce any third substance into the alloy? Or may the influence of centrifugal force be applied during the pouring of the molten mixture? Or are there no other means which may be thought of? It is proposed, at least, to enter upon some experiments upon this subject; and even should these fail, there would always remain one way of getting over the evil;—this would be to adopt, as a monetary standard, a combination of silver and copper which is constant—which is not subject to the singular liquation pointed out: such a compound or alloy is the one first mentioned—718·93 of silver to 281·07 of copper. This is known to remain constantly and perfectly homogeneous. There, perhaps, may be some objections to the adoption of such a change. It may readily be seen what these are, and whether they are valid. It is said that the decimal system is represented in the present French monetary

system, under the triple relation of the nominal value assigned to each piece, its weight, and standard composition. As to the question of value, nothing can be better; and certainly, in that respect, no change could be desired; but the weight and standard are both fictitious, and admit of tolerated variation. Would it be, then, a source of great inconvenience to modify them, with a view of deriving a future considerable and extended benefit?

Society of Arts.

THOMAS MILNER GIBSON, Esq., M.P., Vice-President, in the Chair.

Dec. 11*th*, 1850.

An account of the different methods of Bleaching Flax, Cotton, Linen, Calico, and other Fibres and Fabrics,—by F. Crace Calvert, F.C.S., Professor of Chemistry in the Royal Institution, Manchester, &c., &c.

The author, in commencing his paper, stated that flax was at one period cultivated in warmer climates than at present. It was said that Isis taught the Egyptians to use it; and it is certain that the cloth which enwraps the mummies is made of it.

It is not generally known that there are three distinct varieties of the flax-plant in Belgium, Holland, and France.

1. *Le grand Lin,* from which the finest cambrics are made.
2. *Le Lin chaud,* yielding a large quantity of seed.
3. *Le Lin moyen,* with a fibre of middling quality.

A knowledge of the existence of these varieties would be very useful to the British flax-grower, whose interest it is to sow that kind which will yield him the seed or fibre most wanted in the market.

In 1849, there were imported, chiefly for sowing, 626,459 quarters of seed.*

The processes employed in preparing the flax for manufacture are as follow:—When full grown it is pulled up and gathered into sheaves or bolls; the seed is then shaken out; and the straw is steeped in ponds or small streams for three or four weeks, by which fermentation is caused and acids are generated, which dissolve the gum and resin that unite the fibre to the stalk. By Schenck's method,† water at 90° Fahr. is used, and the steeping is got through in about four days. The retted flax is now exposed on grass for several days, and dried with care; the fibre is then broken away from the stalk, either by hand or in the scutching machine; after which it only requires to be hackled, or combed, to be ready for spinning and weaving.

* The importation of hemp had increased from 40,578 tons in 1847, to 53,013 tons in 1849.

† For description of this process, see Vol. XXXI., p. 1, Lond. Jour.

There are two varieties of cotton-tree: the first an herbaceous plant about two feet high, the other a shrub of larger growth. Both have been long known in Egypt, India, and Arabia, and flourish equally well in the United States of America. Cotton was first introduced into Europe by the Venetians in the fourteenth century; but its manufacture into fabrics was reserved for the men of Lancashire. Much encouragement was given by Henry VIII. and Edward VI. to the nascent trade, which at that time was only practised during the intervals of agriculture. England now imports annually 6,745,259 cwt. of raw cotton; and, besides her home consumption, exports 153,166 pieces of calico, and 375,367 pounds of yarn.

To such wonderful perfection have machinery and skill been brought, that Mr. H. Houldsworth is now able to produce 520 hanks of thread to the pound: that is to say, one pound of cotton-wool, weighing 7000 grains, is susceptible of giving 520 hanks, each being composed of a thread 840 yards in length; or 7000 grains of cotton-wool can give a thread equal in length to 436,810 yards, or 248 miles.

The fine spinning of flax has also been carried to an extraordinary extent; for one pound of flax fibre is susceptible of being spun into a thread 84,496 yards, or 48 miles, in length.

Under the microscope these two fibres present very different appearances: those of cotton have the appearance of irregular ribbons, twisted on each other, and are perfectly transparent in those parts which are not doubled; whilst the flax consists of smooth transparent tubes, intersected at short intervals by joints or knots, similar to those of bamboo or other reeds.

There is an historical fact connected with these two interesting fabrics. It is, that paper made from pith of the Papyrus-plant had lasted from 1822 years before the Christian era to the eighth century. Egypt was then invaded by the Arabians, and her trade destroyed. It was then for the first time that cotton paper was imported from China by the Arabians, who, two or three centuries afterwards, supplied us through Turkey. The manufacture of their flax paper was so successful, that cotton paper was completely laid aside until the commencement of the present century, when once more it expelled from the market the linen paper.

After cotton has been gathered in September, the cotton-wool is separated from the seed and other heterogeneous matters by a machine called a "gin," invented in 1793 by an American named Whitney.

The author next proceeded to draw attention to the bleaching of cotton and flax goods.

The cotton-bleacher has not, he said, like the calico-printer, to ascertain the origin of the cotton-wool; for it is indifferent to him to know that Pernambuco cotton takes colors much better than Georgian does; but the quality of his cloth has a most material influence on the nature of the operations and the strength

of the solutions to which he has to submit it. Thus, in the case of cloth to be employed for printing,—if not perfectly bleached and freed from all resins or gum, it will dye, when put into a madder bath, not only where mordants have been applied, but also on those portions intended to remain white.

Flax goods require no preliminary operations before bleaching, whilst calico requires singeing, *i.e.* the removing of an infinite quantity of small fibres which exist on its surface—an operation which cannot be avoided.

Singeing is effected in three different ways: first, by passing the cloth over red-hot cylinders. Secondly, by passing it over pipes, from which issue numerous jets of coal-gas; above the cloth are corresponding pipes provided with longitudinal openings, into which the flames are drawn through the cloth, by a revolving fan or other means. The third method, recently introduced, is the substitution, for coal-gas, of hydrogen, produced by blowing steam on a bed of red-hot charcoal. After singeing, and before they can be printed on, the cotton goods undergo the different operations of bleaching, to remove from the fibre those heterogeneous matters mingled with it by nature, or introduced into it during its manufacture.

In the bleaching of cotton fabrics, the operations are simple, rapid, and certain. In that of flax they are complicated, long, and full of risk. This difference is owing to the fact, that in cotton goods the fibre is of a uniform nature, and the color to be removed is merely retained by resins and gum; whilst linen, besides the small amount of coloring matters which naturally exist in the fibre, and a large proportion added in steeping, contains little pieces of the reed, called *splints*, caused by the impossibility of completely separating the fibres from the woody parts;—in fact, all the difficulty of bleaching linen rapidly lies in this unavoidable obstacle: that is, when you have bleached it beyond a certain stage, the difficulty is not to get the fibre white, but to preserve it from injury until all the splints are removed. Were it not for this hindrance, there would be little more difficulty in bleaching linen than calico.

The fibre, as it exists in the plant, is nearly white, and the color of ordinary steeped flax, which gives so much trouble to bleach, is owing to the common process of retting. The author offered for inspection a sample retted by a new chemical process which he had discovered, and hoped ere long to bring to such perfection as will render it commercially useful.

With respect to the bleaching of cotton goods, the author said, that it had arrived at such a degree of perfection and rapidity, that, although it usually took four or five days, cotton may be bleached in 24 hours, now that the application of bleaching liquors is thoroughly understood. The operations may be divided under two heads. The first series is for the purpose of removing from the cloth its natural resins, gum, and fatty matter, together with all those substances added to it during its manufacture—

such as oily matters, starch, gelatine (from the sizing of the warp), and often metallic oxides, as those of magnesia, copper, or zinc, &c. The operations of the second series are the true bleaching ones, intended to destroy the natural coloring matter, and those which have been added by the spinners and weavers.

The purpose of the operations is shewn by the following table of substances added during manufacture.

Soluble in water	glue, soda or potash, starch, albumen.	Soluble in caustic alkali	coloring matter, resins.
Soluble in lime water	fatty matters, gluten.	Soluble in acids	gum resins. resins, oxide of iron, and calcareous and other salts.
Soluble in caustic alkali	fatty matters, linen soap, copper soap.		

A great many modes are adopted for the same end; but the following is the process most usually followed in Lancashire:—

No. of hours.	
3h. 0m.	1. Steeped in water.
0 20	2. Washed in wheels.
8 0	3. Boiled with lime and water.
0 20	4. Washed in wheels.
9 0	5. Boiled in a solution of carbonate of soda (soda ash), 60lbs. for 3000lbs. of cloth.
0 20	6. Washed in wheels.
0 30	7. Steeped in weak vitriol, sp. gr. 1·025.
2 10	8. Drained two hours and slightly washed.
3 0	9. Steeped in a very weak solution of bleaching powder.
26 40	

No. of hours.	
26 40	
0 20	10. Washed.
6 0	11. Boiled in a solution of soda ash (carbonate of soda), 30lbs. for 3000lbs. of cloth.
0 10	12. Washed.
10 0	13. Steeped in a very weak solution of bleaching powder.
0 10	14. Washed.
0 20	15. Steeped in a solution of vitriol of sp. gr. 1·025.
1 20	16. Drained one hour, and well washed.
45 hours.	

This process costs the bleacher about 9*d.* per 100 lbs. of cloth.

The bleaching price for calico of 32 to 36 inches wide, and 24 yards in length, is 6*d.*—of 36 to 40 inches wide, and 40 yards long 10*d.*

In the case of fine fabrics, such as muslin, the boiled lime is done away with. Caustic soda is only employed for stouter goods. The carbonate of soda-boil is often replaced by one of soap. The boil with lime is, perhaps, the most important; for lime has great power to change the fatty matters on the cloth into soap; and, being further decomposed by an acid dip, they are in a condition for being rapidly dissolved by the caustic soda produced by the action of the lime which remains on the cloth.

It is admitted, too, that lime so modifies the coloring matters, that they are more rapidly destroyed by the action of chlorine agents. The application of chlorine, as a substitute for the slow action of the air, was first discovered by Berthollet in 1785, but was not in use until 1798; when a compound of chlorine and

lime was first extensively manufactured under the name of Tennant and Knox's bleaching powder. This valuable agent, which is far superior to chlorine, or a solution of that gas, should be well mixed with water, and all the insoluble parts allowed to settle; for, if this is not done, an insoluble compound of chlorine, which forms part of the undissolved powder, attaches itself to the calico, and, when it is dipped in acid, is decomposed, and disengages, on the spot, such an amount of chlorine that the cloth is instantly burned.

The strength of the chlorine solution employed depends upon the quality of goods and the mode of bleaching adopted. In the "slow process," after a dip of a few hours in the bleaching liquors, the pieces are left on stone flags for a long time; while in the "mechanical process," several thousand yards of cloth are attached together, and passed, by suitable contrivances, successively into the different liquors. Gum thurst is sometimes employed; but its advantages scarcely compensate for its cost.

During trials which the author made on bleaching, it occurred to him that the following process would be cheaper and more rapid than the one now made use of:—First, treat the calico with weak muriatic acid for a few hours at the temperature of 200° Fahr., which will change the starch of the warp into sugar, and, by removing it from the cloth, facilitate the action of the alkalies on the fatty matters. To destroy these, employ a partly caustic solution of carbonate of soda. Then dip in muriatic acid, next in bleaching liquor, and, lastly, in muriatic acid. Muriatic acid is preferred to sulphuric for several reasons. First, because by not forming the very slightly soluble salt gypsum on the cloth with the lime, it does not prevent the free action of chlorine on its compounds. Secondly, because it more effectually decomposes the bleaching compounds of the bleaching powder.

The bleaching of linen is materially different to that of cotton, owing to the nature of the fibres, and of the organic substances which unite them being different; and because still greater care must be taken by the bleacher to employ such means as will remove the resins and gum which unite the coloring matter to the fibre, without altering those which unite the minute tubes constituting the real fibre. He arrives at this, the real end of his art, by employing milder means, and almost entirely avoiding bleaching agents, which, even when employed with great care, are likely to injure the fibres.

The process consists in steeping the linen in cold water for several hours; after which, it is boiled in a weak solution of carbonate of soda, or with a partly caustic lye, to which is added gum fust. After twelve hours' boil under a slight pressure in the above fluid, indicating 1° or 2° Twaddle (or of sp. gr. ·02), it is well washed, and then spread out during five or eight days on the grass. After two or three such treatments, the linen, together with a thick soap-lather, is passed between two pieces of wood,

moving in alternate horizontal directions, called rubbing boards. Then, after another boil and exposure, it is dipped for twelve hours in a solution of vitriol, indicating 1° Twaddle. It is then boiled, rubbed, again exposed, and lastly undergoes immersion for several hours in a very weak solution of bleaching liquor. The operations are as follow:—

1. Steep twelve hours in cold water.
2. The whole is then carried to the boil.
3. Wash.
4. Boil 12 hours in carbonate of soda, caustic lye, or resin soap.
5. Expose on grass for four to eight days.
6. Boil, as before.
7. Wash.
8. Expose, as before.
9. Boil.
10. Wash.
11. Expose on grass.
12. Steep in sulphuric acid of sp. gr. 1·02.
13. Wash.
14. Boil.
15. Expose.
16. Scald.
17. Rub.
18. Wash.
19. Expose, 2 to 4 days.
20. Scald with soap.
21. Wash.
22. Rub.
23. Wash.
24. Expose.
25. Acid.
26. Wash.
27. Bleaching liquor.
28. Wash.
29. Scald.
30. Wash.
31. Expose.
32. Acid.
33. Wash.
34. Bleaching liquor.
35. Wash.
36. Dry.

In bleaching, linen loses 18 per cent. of matter soluble in alkali, and from 28 to 30 per cent. of its weight during its change from a brown to a white cloth. Calico contains 5 per cent. of substances susceptible of being dissolved by alkalies, and loses in bleaching about 28 per cent. in weight.

This process occupies about six weeks in summer and three months in winter. The author stated that, after long trials, he had arrived at a means of bleaching linen in three or four weeks, without, in the slightest degree, injuring the fibres; as was proved in the working of the process on a large scale in Ireland.

During exposure on grass, the oxygen of the air appears to act on the coloring matters by removing their hydrogen, converting them into substances similar to acids, and therefore more soluble in alkalies. This is borne out by the fact that dew or snow, which contain air, and are very rich in oxygen, help very materially the bleaching of linen. There is also no doubt that the oxygen converts the fatty matters into fatty acids, which are easily removed from the cloth as soluble soaps.

In the bleaching of linen, it is more important than in that of calico, that, after each boil or dip, the cloth should be perfectly freed from all trace of the substance composing the liquor. With this view, a great variety of machines is employed; but those which are preferred are the dash-wheel, fly-winches, and Robinson's new patent washing-machine: in Ireland, generally, the old system of washing is used.

Several years since, the author succeeded in finding a very simple process for bleaching jute and china grass,—samples of which were shewn to the Society.

The author urged, as a matter of national importance, the extended cultivation and manufacture of flax. Three acres, he said, of land, realising a crop worth £75, are capable of giving employment to 216 spinners, weavers, and needlewomen, whose

labour, although being equal to £2217, leaves a profit of £332 to their employer, by having manufactured 1050 pocket handkerchiefs, at £2. 10*s.* per dozen.

Lastly, by the use of Mr. Schenck's steeping process, not only is all the seed saved, but, for a long, unwholesome, and difficult operation, we have one safe, healthy, and economical. For Schenck's rapid process prevents the production of the large amount of noxious gases (wide source of disease), besides the risk of losing an entire crop, as is often the case when the farmer is obliged to steep his flax;—a few hours being sufficient to destroy the fibre, and thus to deprive him of all return. The variety of fabrics into which flax can be woven should not be lost sight of; for it is capable alike of being worked up as ladies' fine cambric, or as mechanics' fustian (which has of late been successfully manufactured in Ireland). The durability and beauty of its products, and the much greater brilliancy of the colors printed or dyed on linen than when fixed on calico, should not be lost sight of; as it always possesses that gloss which is artificially obtained on cotton by starch and pressure, only to be destroyed by the first washing.

DEC. 18TH, 1850.

CHARLES DICKENS, Esq., in the Chair.

MR. W. BRIDGES ADAMS *read a paper on the influence and extension of railways.*

He commenced by shewing that roads were the origin of all human civilisation; that on the water roads—the rivers and sea-coasts—are found the earliest settlements of mankind; that the civilisation of elder Greece was probably due to the mingling of the Scandinavian race with the Aborigines in the coasting cruises of the sea-kings; that the interiors of all countries were the last to become civilised, for the want of roads; and that the Romans, the most powerful nation of the old world, were the greatest road-makers. That knowledge, in the wide sense, could not exist without roads; and, in that case, wisdom, or the dominion over knowledge, would have but a narrow field of rule. As railways are the most perfect of existing roads, they may be considered as the synonym of high civilisation.

Mr. Adams then went on to compare the civilising effects of roads and of the printing-press. He considered the former to be wider in their results; inasmuch as the press has but a narrowed effect between nations speaking different languages; whereas the road, but especially the railroad, by bringing men face to face, and with speech to speech, has a tendency to fuse language, to break down dialects, to generate an universal language, and ultimately to destroy national rivalries. The "republic of letters" is ever cosmopolitan, but only in a narrow circle. The republic of railways will be world-wide.

The macadamised system of roads had attained great perfection

on a surface of irregular mosaic work; but the cost of transit thereon rendered them an appliance useful only to the comparatively wealthy. And even the river to Gravesend, by reason of the slowness and uncertainty, precluded poor men from travelling, whose time was their maintenance.

Railways are commonly called an invention; but they are not so. An invention is a process of forethought. Columbus *invented* America, for European men, by forethought. Railways are only *contrivances*, or after thoughts,—a consecutive series of remedies for constantly occurring defects. A plank was first laid down to mend a rut; then the plank was sheathed with iron to prevent too rapid wear; then a cast-iron rail was laid down, with an upward projecting edge, and called a tramway; then the edge or flange was transferred to the wheels, and the rails became edge rails; and then followed the flat bar on timber; and then the bridge rail, and the fish-bellied rail, and double T-rail, supposed fit to reverse four times, but not answering in practice. Next followed chairs and stone blocks, and chairs and cross sleepers, and longitudinal sleepers without chairs, and the hog-trough metal sleepers of the Great-Western experiment, and Greaves' cast-iron dish-cover sleepers, and longitudinal timber-bedded rails, and Barlow's cast-iron vice-sleepers, and the wrought-iron bitumenised sleepers, and cast-iron trough-sleepers wood-lined, and Barlow's longitudinal saddle-back rail, and the cylindrical bar rail of Welsh quarrymen. All these were mere contrivances; but the cost of £300 annually per mile for maintenance of road was a proof that the perfect railway was still to be invented.

The first propounder in print of a general system of iron railways with steam traction, for public transit, was Thomas Gray, in the year 1820. He also agitated specifically for a line between Liverpool and Manchester; but his object was slow travelling and heavy loads. He besieged every one, from ministers of state downwards, with his plans; but lived neglected and died poor; while men around him became rich by buying and selling shares in the lines he first agitated.

Yet George Stephenson *was* an inventor in the large sense of the word. He *prophesied*, *i. e.* foretold, a railway over a quaking moss, whereon a fire-steed might travel at thirty miles per hour, and for his pains was called a madman. He created, practically, a new combination out of materials till then very imperfectly understood, and still not thoroughly comprehended.

The subsequent variation of gauges, and the contest for speed, has resulted in the generation of monster machines, whose power is far in excess of the strength of the fulcrum on which they work,—the rails and railway. Engines weighing 53 and 59 tons, occupying fourteen wheels each, cannot work profitably, either commercially or mechanically. The railway, the engines, and the carriages are still comparatively crude, and the cost, both in outlay and working, will probably be reduced to one-half. Even

as they are, they are the real source of increasing national capital; but they are worked at present with a view only to direct profit in the shape of tolls. The time is coming when the indirect profits will make tolls a comparatively small object.

Highways have a tendency to grow into streets, just as Oxford Road has become Oxford Street, because people can build on the borders without risk of being denied access, and without fear of heavy tolls. But the *rail coast* remains a desert, because the interests of the landowners and the railowners are opposed. The legislature prohibits the railway companies from owning land or buildings, or from any source of profit but tolls and transit. Therefore, they are analogous to the toll-enforcing barons of the feudal times, exacting all they can up to the prohibition limit of the Act of Parliament. The manifest interest of the companies is to encourage population along their borders, as the *dry rivers* of the country; but the public fear to put their heads into the lion's mouth, knowing he has teeth, though it may suit him to hide them for the time.

The principles that govern a landowner in laying out his estate for building, should govern the laying out of railways. The property is not made for the road, but the road for the property. A railway, constructed as a convenient mode of transit for all persons dwelling near it, and for all results of operations in agriculture and manufactures on its borders, would be provided with water-pipes, sewage-pipes, gas-pipes, and stopping places, every quarter mile distance. It would be constructed in the most permanent manner to minimise traction, and it would be worked only to pay actual costs. The profits would be in the increased value of rents. Siding rails would run into farm-yards, and the markets would be at the stations and termini. Factories would be interspersed, and all waste and sewage would go on to the farms direct. Coals being thus borne cheaply on to the farms, power machinery would rapidly increase, and farm-labourers would rapidly acquire mechanical skill. Temporary rails would become a farm utensil, as they now are the utensils of road-contractors, and contrivances innumerable would be the result. Improved buildings of all kinds would arise, and especially dwellings, wherein expenditure would be minimised and comfort maximised; and farm workmen and factory workmen, dwelling beneath the same roof, would cease to be *classes*, and would fuse together, producing the effect of each individual continuing in, or changing to, the employment for which he might have a natural aptitude. Children would thus be better educated, under the eyes of their parents, without the domestic affections being weakened. Domestic drudgery of all kinds would be diminished by the use of the steam-engine, and general cleanliness and moral habits would grow up. It would be scarcely possible for thieves or paupers to be bred under such a system.

Our chief difficulties in sanitary questions and economical arrangements have arisen from the bit-by-bit growth of our towns

without plan, while transit was costly and almost impracticable for the masses. The water question, the sewage question, the ventilation question, are all involved in the want of original method. Facility of cheap and rapid transit solves them all, by enabling people to live more dispersed.

There is needing an *influential landholder* to be to the agricultural railway-maker what a Bridgewater was to the canal-maker, and a Devonshire has been to the horticulturist, to multiply manyfold his own revenue while being the world's benefactor.

The turnpike-roads of the whole country are now comparatively waste by the advent of railways, and property along their borders is comparatively valueless. It would be easy to convert these turnpike-roads into a system of practicable railways, by inserting rails level with the surface to travel on, at stage-coach speed, by steam. There are 22,000 miles, on which £8,000,000 have been borrowed, and interest is largely in arrear. The reason why steam formerly failed on the turnpike-roads was the want of rails as a fulcrum. For farm purposes and horse traction £500 per mile would suffice; for steam, including engines and platform carriages, fitted either for travellers or goods, £2000 to £2500 per mile would suffice. With light transit there would be scarcely any "maintenance of way." At present, common transit averages £33 per mile per annum. The gradients do not present any great difficulty with light vehicles. An incline of one in thirty-seven on the Birmingham and Gloucester has been worked for many years with heavy machines. And when rails are laid in turnpike-roads, the hills would very soon pay for improving. This arrangement would place the whole of the agricultural districts of England in a rapidly improving condition,—the farms at one end of the rail and the markets at the other. At present, chemistry has done more than mechanism for agriculture. The ordinary traffic would not be interfered with by this plan of rails, as vehicles could cross and recross them.

And the same principle of laying down rails as branch lines, and as omnibus lines in the outskirts, and through main avenues of large towns, without impeding ordinary traffic, must, sooner or later, be adopted. The existing railways do not subserve the public want—of people getting easily to their own doors. In Birmingham and Manchester the railways go into the towns, though inconveniently; but in London the distance to the railways is great. There are numerous outlets applicable to this. The South-Western Railway, in this mode, might have been connected with Waterloo and London Bridges at an outlay of tens instead of hundreds.

Mr. Adams practically demonstrated, by reference to existing facts, that none of these apparently novel propositions are novel, save in their systematic combination, substituting a plan for the usual hap-hazard work; that only by a clear *plan* and survey of the whole scope of the original work that is yet to do in chemistry and mechanics, and by fitting, and not misfitting, men and

women to occupations analogous to their several natural aptitudes, can rapid progress be made.

The want of general education is the true cause of the mass of crude ideas brought forward by ignorant people and charlatans, and has thus tended to make the words "schemer" and "inventor,"—words of high import to mankind—the synonyms of ignorance and absurdity with the vulgar mass, just as ignorant and absurd in other ways. If there be a class ignorantly sanguine, so also is there a class as ignorantly incredulous, living only for the immediate gratification of self, and who, were they in sufficient numbers, would make us a nation of Chinese, reproducing eternally, and originating nothing.

Into the practical details of the railway question, Mr. Adams scarcely entered, deferring them to a future paper, in which he proposed distinctly to state the principles that should govern railway economy, and the existing practical appliances most nearly developing those principles; believing, that in the railway, this latest mode of perfecting human intercourse, conjoined with the giant iron steamers that will span the narrow and the broad seas, —that will raise Ireland to a land of plenty as the connecting link between England and America,—would be found the true solution of the problem of universal peace.

INSTITUTION OF CIVIL ENGINEERS.

January 14th, 1851.

WILLIAM CUBITT, Esq., President,—in the Chair.

The paper read was "*On the construction of the Building for the Exhibition of the Works of Industry of All Nations in* 1851," by Mr. M. D. Wyatt, Assoc. Inst. C.E.

The paper, which was unavoidably of very considerable length, commenced by characterizing the first attempt to concentrate within the compass of a few acres, specimens of the productive industry of all nations, as a "great experiment," worthy of being tried upon a scale commensurate with the energy of the industrial resources of this country. The success of this experiment must depend on a just apprehension of the results to be produced—a well-digested scheme for producing the results aimed at—and power and dexterity to arrange the whole, so as to insure the accordance and working of all its parts in the simplest and best manner. The subject, then, naturally divided itself into the consideration of the requisites demanded—the design—and the actual construction of the building.

The features of all the buildings in which previous exhibitions had been held, both abroad and at home, were then carefully

reviewed, and the points of difference between the present cosmopolitan exhibition and all its predecessors were distinctly enunciated, and shewn to have induced the invitation to the world at large to contribute their suggestions for the building, the results of which were shewn to the public in the Theatre of the Institution of Civil Engineers, in the two hundred and forty plans there exhibited. None of these plans being found to embrace the necessary requisites, the Royal Commissioners devised a plan, for the execution of which tenders were invited in June, 1850.

The reservation having been made that *bonâ-fide* tenders for any construction, offering greater advantages than that proposed by the Commissioners, would be considered, Mr. Paxton brought forward his proposition; and it being contended that certain advantages in celerity of construction, facility of removal, the adaptability of the materials to the required forms, and the amount of cost, were inherent in the design for the proposed structure, to be entirely composed of wood, iron, and glass—the other tenders were rejected, and that of Messrs. Fox, Henderson, and Co., for Mr. Paxton's design was accepted.

Such was the origin of the present building; which, being adapted to the site selected for it, in Hyde Park, by H.R.H. Prince Albert, was shewn to consist of a nave 72 feet wide and 64 feet high, with a series of side aisles, two of 48 feet and six of 24 feet wide, of the respective heights of 43 feet and 23 feet; the whole spreading to a width of 436 feet.

A transept, 408 feet long and 72 feet wide, intersected the building at right angles in the centre: this transept was covered with a semi-circular roof, springing at a height of 64 feet from the level of the ground, and making the entire height 100 feet.

The details of the construction were very minutely given. The total area of the ground floor was said to equal 772,784 square feet, and that of the galleries 217,100 square feet.

Details were also given of the mode of conveying the rain water, &c., into the adjoining sewers, through the interior of the supporting columns; of the ventilation, by means of sets of louvres, of galvanized cast iron, placed between the columns of the side aisles, and in the upper part of the roof; of the supply of water for the extinction of fire, and for the supply of the fountains; and of the experiments for testing the girders and trusses, by the hydraulic press erected in the building, and by which the strength of the whole was proved before they were used.

In examining the power and dexterity with which the design had been realized by Messrs. Fox, Henderson, and Co. (or, in other words, in the actual construction of the building) it was necessary to bear in mind, that their tender was only verbally accepted on the 26th of July, 1850, that possession of the site was obtained on the 30th of July, that the first column was fixed on the 26th of September, and at the present time (only 145

working days since the commencement) but little of the vast building remained to be finished. To give an idea of the vast size of this building, it was noticed, that the width of the main avenue was within 10 feet double that of the nave of St. Paul's Cathedral, whilst its length was more than four times as great. The walls of St. Paul's were 14 feet thick, those of the glass building in Hyde Park were only 8 inches. St. Paul's occupied 35 years in building, whilst the Hyde Park building would be finished in less than half that number of weeks. The celerity of the construction was very remarkable. As many as 308 girders had been delivered on the ground in one week. Seven of the great trusses of the nave were raised in one day. Each man fixed about 200 superficial feet of glass per day.

In order to perform this work, it was necessary to devise and employ various contrivances for economising labour; such as the sash-bar machine, the gutter machine, the morticing machine, the painting machine, the glazing machine, besides many others of an equally ingenious nature—all of which were described; and, when listening to the details, it was universally felt, that England possessed mechanical and physical energies far exceeding those which gave form and being to the most celebrated monuments of antiquity.

In the course of the paper, Mr. Digby Wyatt (the author), to whom, from the commencement, had been entrusted the active superintendence of the construction of the building, paid a well-merited tribute of praise to Mr. C. H. Wild and Mr. Owen Jones, who had been associated with him; to Mr. Barry and Mr. Brunel, who, as members of the Building Committee, had made very valuable suggestions; as well as to Messrs. Fox and Henderson, and to Mr. Brounger, Mr. J. Cochrane, and others, for their exertions in the execution of the construction; and he concluded by reminding the members, that the weight of responsibility, the arduous duty of supervision, the honor of acting as the master mind, to weigh the requisites, to determine the design, and to govern the construction of this great apparatus, had been reserved for Mr. Cubitt, the President of the Institution of Civil Engineers.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th December, 1850, to 17th January, 1851.

To Joseph Findlay, of New Snedden-street, Paisley, in the county of Renfrew, North Britain, manufacturer, for an improvement or improvements in machinery or apparatus for turning, shaping, or reducing wood or other substances.—Sealed 19th December.

William Henry Green, of No. 8, Basinghall-street, in the City of London, Gent., for improvements in the preparation of peat and other ligneous and carbonaceous substances, and the conversion of some of the products derived thereby; and also in the mode of the application of some of such products to the preservation of substances liable to decomposition and destructive agencies; and which mode is also applicable to other products of a similar nature,—being a foreign communication.—Sealed 21st December.

Peter Woods, of the firm of Thomas Bury & Co., dyers, calenderers, and finishers, Adelphi Works, Salford, in the county of Lancaster, for improvements in figuring and ornamenting woven and textile fabrics, paper, wood, leather, and all kinds of material, substances, or compositions; and in machinery employed therein.—Sealed 24th December.

Henry Bessemer, of Baxter House, St. Pancras-road, in the county of Middlesex, engineer, for certain improvements in apparatus, acting by centrifugal force, in the manufacture of sugar; and other improvements in the treatment of saccharine matter by such apparatus.—Sealed 31st December.

Charles William Lancaster, of New Bond-street, in the county of Middlesex, gun-maker, for improvements in the construction of fire-arms, cannon, and projectiles; and in the manufacture of percussion tubes.—Sealed 3rd January.

George Edward Dering, of Lockleys, in the county of Herts, Esq., for improvements in the means of, and apparatus for, communicating intelligence by electricity.—Sealed 4th January.

Joseph Eccles, of Moorgate Fold Mill, near Blackburn, in the county of Lancaster, cotton spinner and manufacturer, and James Bradshaw and William Bradshaw, of Blackburn, in the said county, watch-makers, for certain improvements in and applicable to looms for weaving various descriptions of plain and ornamental textile fabrics.—Sealed 4th January.

James Thomson, of Glasgow, in the county of Lanark, civil engineer, for improvements in hydraulic machinery, and in steam-engines.—Sealed 10th January.

List of Patents

Granted for SCOTLAND, subsequent to 22nd December, 1850.

To Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for improvements in cutting and dressing stone,—being a communication.—Sealed 23rd December.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for improvements in

the manufacture of iron hurdles or fences, and of certain other articles in the construction of which wire-work is or may be employed,—being a communication.—Sealed 23rd December.

Thomas Allan, of Glasgow, iron-founder, for certain improvements in paving or covering roads, streets, and other surfaces of a similar nature.—Sealed 23rd December.

William Hodgson Gratrix, of Salford, engineer, for certain improvements in the method of producing or manufacturing velvets or other piled fabrics.—Sealed 24th December.

James Nasmyth, of Patricroft, in the county of Lancaster, engineer, and John Barlow, of Manchester, copper roller manufacturer, for certain improvements in machinery or apparatus for printing calicoes and other surfaces, and also improvements in the manufacture of copper or other metallic rollers to be employed therein; and in the machinery or apparatus connected with such manufacture.—Sealed 24th December.

Francis Edward Colegrave, of Brighton, Esq., for improvements in the valves of steam and other engines; in causing the driving-wheels of locomotive engines to bite the rails; and also in supplying water to steam-boilers.—Sealed 31st December.

Thomas Brown, of Muscovy-court, Tower-hill, London, for improvements in machinery for raising and lowering weights.—Sealed 31st December.

Edward D'Orville and John Partington, of Manchester, manufacturers, for certain improvements in finishing thread or yarn.—Sealed 31st December.

James Forster, of Liverpool, merchant, for improvements in filtering water and other liquids.—Sealed 31st December.

James Hill, of Stalybridge, in the county of Chester, cotton spinner, for improvements in or applicable to certain machines for preparing cotton, wool, and other fibrous substances, for spinning and doubling.—Sealed 3rd January.

Henry Bessemer, of Baxter House, St. Pancras-road, London, engineer, for certain improvements in apparatus, acting by centrifugal force, in the manufacture of sugar; and other improvements in the treatment of saccharine matter by such apparatus. Sealed 6th January.

Lucien Vidie, of No. 14, Rue du Grand Chantier, Paris, advocate, for certain improvements in measuring the pressure of air, steam, gas, and liquids.—Sealed 8th January.

John Coope Haddan, of Bloomsbury-square, London, engineer, for improvements in the manufacture of railway carriages and of railway wheels; and also of panels for carriages and other purposes.—Sealed 9th January.

Samuel Hall, late of Basford, near Nottingham, engineer, for improvements in the manufacture of starch and gums; and in furnaces and steam-boilers, with safety-apparatus to be used in such manufactures, and for other purposes.—Sealed 10th January.

John Corry, of Belfast, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics; which machinery or apparatus is also applicable to other purposes for which Jacquard apparatus is or may be employed.—Sealed 13th January.

John Ransom St. John, of the City of New York, United States, engineer, for improvements in the process of, and apparatus for, manufacturing soap,—being partly a communication.—Sealed 15th January.

John Clarkson Milns and Samuel Pickstone, of Radcliffe Bridge, in the county of Lancaster, manufacturers, for certain improvements in machinery or apparatus used in spinning, doubling, and weaving cotton, flax, and other fibrous substances.—Sealed 20th January.

Joseph Gibbs, of Devonshire-street, London, civil engineer, for improvements in manufacturing paints and cements, and panels or surfaces on which paints or cements are to be or may be applied; part of which improvements are applicable to other useful purposes.—Sealed 20th January.

Edward Clarence Shepard, of Parliament-street, Westminster, for certain improvements in electro-magnetic apparatus, suitable for the production of motive power, of heat, and of light; being a communication.—Sealed 22nd January.

New Patents

SEALED IN ENGLAND.

1851.

To John Tatham and David Cheetham, of Rochdale, in the county of Lancaster, machine-makers, for certain improvements in steam-engines, in apparatus for generating and indicating the pressure of steam, and for filtering water, to be supplied to boilers; also improvements applicable to steam-vessels or ships. Sealed 2nd January—6 months for inrolment.

Joshua Horton, of Ætna Works, Smethwick, in the county of Stafford, steam-engine boiler, and gas-holder manufacturer, trading under the firm or style of Joshua and William Horton, for improvements in the construction of gas-holders. Sealed 2nd January—6 months for inrolment.

John Corry, of Belfast, in the Kingdom of Ireland, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics; which machinery or apparatus is also applicable to other purposes for which Jacquard apparatus is or may be employed. Sealed 2nd January—6 months for inrolment.

Benjamin Cook, of Birmingham, in the county of Warwick, manufacturer, for a certain improvement or certain improvements in the manufacture of metallic tubes. Sealed 2nd January—6 months for inrolment.

John Percy, of Birmingham, in the county of Warwick, Doctor of Medicine, and Henry Wiggin, of Birmingham, manufacturer, for a new metallic alloy, or new metallic alloys. Sealed 2nd January—6 months for inrolment.

Thomas Lawes, of City-road, in the county of Middlesex, for improvements in generating and applying steam for certain purposes. Sealed 4th January—6 months for inrolment.

John Harcourt Brown, of Fir Cottage, Putney, Surrey, Gent., for certain improvements in the manufacture of wafers. Sealed 7th January—6 months for inrolment.

Henry Grissell, of the Regent's Canal Iron Works, in the county of Middlesex, engineer, and Theophilus Redwood, of Montague-street, in the same county, Professor of Chemistry, for improvements in coating metals with other metals. Sealed 11th January—6 months for inrolment.

John Alexander Archer, of the Broadway, Westminster, tobacco manufacturer, for improvements in the manufacture of tobacco. Sealed 11th January—6 months for inrolment.

Samuel Hall, late of Basford, near Nottingham, civil engineer, for improvements in the manufacture of starch and gums. Sealed 11th January—6 months for inrolment.

William Melville, of Roe Bank Works, Lochwinnock, in the county of Renfrew, North Britain, calico printer, for certain improvements in manufacturing and printing carpets and other fabrics. Sealed 11th January—6 months for inrolment.

Thomas Allan, of Glasgow, in the county of Lanark, North Britain, iron-founder, for certain improvements in paving or covering roads, streets, and other surfaces of a similar nature. Sealed 11th January—6 months for inrolment.

George Anstey, of Brighton, in the county of Sussex, Gent., for certain improvements in consuming smoke and in regulating the draft in chimneys. Sealed 11th January—6 months for inrolment.

William Robinson, of Halsham, in Holderness, in the East Riding of the county of York, machinist and agricultural implement maker, for improved machinery for separating corn from straw. Sealed 11th January—6 months for inrolment.

John Clarkson Milns and Samuel Pickstone, of Radcliffe Bridge, in the county of Lancaster, manufacturers, for certain improvements in machinery or apparatus used in spinning, doubling, and weaving cotton, flax, and other fibrous substances. Sealed 11th January—6 months for inrolment.

Alexander Speid Livingstone, of Swansea, in the county of Glamorgan, engineer, for improvements in the manufacture of fuel. Sealed 11th January—6 months for inrolment.

Charles Barlow, of Chancery-lane, London, Esq., for improvements in propelling,—being a communication. Sealed 11th January—6 months for inrolment.

Charles Barlow, of Chancery-lane, London, Esq., for improvements in machinery for the manufacture of railway-chairs. Sealed 14th January—6 months for inrolment.

Gustav Adolph Buchholz, of Agar-street, Strand, in the county of Middlesex, civil engineer, for improvements in printing, and in the manufacture of printing apparatus; and also in folding and cutting apparatus. Sealed 16th January—6 months for inrolment.

Robert Cogan, of Leicester-square, in the county of Middlesex, glass merchant, for improvements in the application of plain or ornamental glass, alone, or in combination with other suitable materials, to new and useful purposes of construction or manufacture. Sealed 16th January—6 months for inrolment.

Charles Cowper, of Southampton-buildings, Chancery-lane, patent agent, for improvements in the construction of apparatus for manufacturing, and apparatus for retaining and drawing off, soda-water and other aerated liquors. Sealed 16th January—6 months for inrolment.

Frederick Watson, of Moss-lane, Hulme, Manchester, Gent., for improvements in sails, rigging, and ships' fittings and machinery, and apparatus employed therein. Sealed 16th January—6 months for inrolment.

Charles William Lancaster, of New Bond-street, in the county of Middlesex, gun-maker, for improvements in the manufacture of fire-arms and cannons, and of projectiles. Sealed 16th January—6 months for inrolment.

Jean Marie Taurines, of Paris, in the Republic of France, engineer, for certain improvements in the machinery and apparatus for measuring and regulating the working of engines. Sealed 16th January—6 months for inrolment.

Richard Bycroft, of Paradise, Walsoken, in the county of Norfolk, Gent., for improvements in apparatus to be used by persons to secure warmth and dryness when travelling. Sealed 18th January—6 months for inrolment.

George Norman, of Shoreditch, in the county of Middlesex, cabinet-maker, for an improved cooking and boiling apparatus. Sealed 18th January—6 months for inrolment.

George Frederick Muntz, jun., of Birmingham, Gent., for improvements in furnaces, applicable to the melting of metals for making brass, yellow metal, and other compound metals. Sealed 18th January—6 months for inrolment.

John Lienau, jun., of Wharf-road, City-road, in the county of Middlesex, merchant, for improvements in purifying or filtering oils and other liquids. Sealed 18th January—6 months for inrolment.

William Rees, of Pembrey, in the county of Carmarthen, coal agent, for certain improvements in the preparation of fuel. Sealed 18th January—6 months for inrolment.

Edmund Pace, of the firm of Taylor and Pace, of Queen-street, in the City of London, iron bedstead-makers, for certain improvements in bedsteads, couches, chairs, and other like articles of furniture. Sealed 21st January—6 months for inrolment.

George Elliot, of St. Helens, in the county of Lancaster, chemist, for improvements in the manufacture of alkali. Sealed 21st January—6 months for inrolment.

William Burgess, of Newgate-street, in the City of London, gutta-percha dealer, for improvements in machinery for cutting turnips and other substances. Sealed 21st January—6 months for inrolment.

Robert William Sievier, of Upper Holloway, in the county of Middlesex, Gent., for improvements in weaving and printing or staining textile goods or fabrics. Sealed 21st January—6 months for inrolment.

Charles Roper Mead, of Charlotte Cottages, Old Kent-road, mechanical engineer, for improvements in apparatus for measuring gas, water, and other fluids. Sealed 21st January—6 months for inrolment.

John Ransom St. John, of the City and State of New York, in the United States of America, engineer, for improvements in the process of, and apparatus for, manufacturing soap,—being partly a communication. Sealed 21st January—6 months for inrolment.

Samuel Clift, of the township of Bradford, near Manchester, manufacturing chemist, for improvements in the manufacture of potash, soda, and glass. Sealed 21st January—6 months for inrolment.

Auguste Loradoux, of Bedford-street, Strand, for certain improvements in machinery or apparatus for raising water and other fluids,—being a communication. Sealed 23rd January—6 months for inrolment.

Alexander Samuelson, of Banbury, agricultural implement manufacturer, for improvements in apparatus for cutting turnips, carrots, mangold wurzel, and other vegetables. Sealed 23rd January—6 months for inrolment.

Joseph Bunnett, of Deptford, in the county of Kent, engineer, for certain improvements in public carriages for the conveyance of passengers. Sealed 23rd January—6 months for inrolment.

Joseph Crossley, of Halifax, for improvements in the manufacture of carpets, rugs, and other fabrics. Sealed 28th January—6 months for inrolment.

CELESTIAL PHENOMENA FOR FEBRUARY, 1851.

D.	H.	M.	
1			Clock before the ☉ 13m. 52s.
	—		☽ rises 7h. 35m. M.
	—		☽ pass mer. 0h. 27m. A.
	—		☽ sets 5h. 4m. A.
	6	2	Ecliptic conj. or ● new moon
2			☽ in Apogee
	1	43	♃'s third sat. will im.
	10	40	☿ stationary
4	1	0	♀ greatest hel. lat. N.
5			Clock before the ☉ 14m. 18s.
	—		☽ rises 9h. 31m. M.
	—		☽ pass mer. 3h. 20m. A.
	—		☽ sets 9h. 21m. A.
6	2	19	♄ in conj. with the ☽ diff. of dec. 2. 48. N.
	21	22	♅ in conj. with the ☽ diff. of dec. 5. 1. N.
	22	20	♃ stationary
9	1	30	♃'s first sat. will im.
	5	40	♃'s third sat will im.
9	8	56	☽ in □ or first quarter
10			Clock before the ☉ 14m. 32s.
	—		☽ rises 11h. 30m. M.
	—		☽ pass mer. 7h. 11m. A.
	—		☽ sets 1h. 52m. M.
12	1	31	♃'s second sat. will im.
14			Mercury R. A. 20h. 3m. dec. 19. 52. S.
	—		Venus R. A. 18h. 38m. dec. 19. 10. S.
	—		Mars R. A. 20h. 30m. dec. 19. 59. S.
	—		Vesta, R. A., 16h. 26m. dec. 15. 13. S.
	—		Juno, R. A., 17h. 17m. dec. 11. 32. S.
	—		Pallas, R. A., 23h. 7m. dec. 5. 24. S.
	—		Ceres R. A. 1h. 4m. dec. 0. 43. S.
	—		Jupiter R. A. 13h. 26m. dec. 7. 33. S.
	—		Saturn R. A. 1h. 6m. dec. 4. 34. N.
	—		Uranus R. A. 1h. 41m. dec. 9. 57. N.
	—		Mercury pass mer. 22h. 28m.
	—		Venus pass mer. 21h. 2m.

D.	H.	M.	
14			Mars pass mer. 22h. 54m.
	—		Jupiter pass mer. 15h. 48m.
	—		Saturn pass mer. 3h. 30m.
	—		Uranus pass mer. 4h. 5m.
15	11	15	☿ greatest elong.
	—		Clock before the ☉ 14m. 26s.
	—		☽ rises 4h. 29m. A.
	—		☽ pass mer. Morn.
	—		☽ sets 6h. 25m. M.
	13	0	☽ in Perigee
16	3	28	Ecliptic oppo. or ○ full moon
	3	23	♃'s first sat. will im.
	6	15	Pallas in the descending node
17			Ceres in conj. with ♄ diff. of dec. 4. 52. S.
	—		Occul. *b* Virginis, im. 13h. 2m. em. 14h. 9m.
	1	15	☿ in the descending node
19	4	4	♃'s second sat. will im.
	6	47	♃ in conj. with the ☽ diff. of dec. 3. 53. S.
20			Clock before the ☉ 14m. 2s.
	—		☽ rises 11h. 18m. A.
	—		☽ pass mer. 3h. 49m. M.
	—		☽ sets 9h. 24m. M.
21			Occul. γ Libræ, im. 12h. 13m. em. 13h. 14m.
	—		Occul. ν Libræ, im. 17h. 11m. em. 18h. 28m.
22	9	38	☽ in □ or last quarter
23	5	16	♃'s first sat. will im.
24	11	45	♃'s first sat. will im.
25			Clock before the ☉ 13m. 22s.
	—		☽ rises 3h. 46m. M.
	—		☽ pass mer. 7h. 59m. M.
	—		☽ sets 0h. 11m. A.
	10		♀ greatest elong. 46. 12. W.
26			♄ greatest hel. lat. S.
	5	3	♀ in conj. with the ☽ diff. of dec. 1. 35. N.
27	5	1	☿ in Aphelion.
28	7	35	☿ in conj. with ♂ diff. of dec. 0. 24. S.
	9	18	♂ in conj. with the ☽ diff. of dec. 0. 6. S.
	9	24	☿ in conj. with the ☽ diff. of dec. 0. 30. S.

J. LEWTHWAITE, Rotherhithe.

THE

LONDON JOURNAL,

AND

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CONJOINED SERIES.

No. CCXXXI.

RECENT PATENTS.

To Francis Edward Colegrave, *of Brighton, in the county of Sussex, Esq., for improvements in the valves of steam and other engines, in causing the driving-wheels of locomotive engines to bite the rails, and also in supplying water to steam-boilers.*—[Sealed 3rd July, 1850.]

This invention relates, firstly, to an improved mode of constructing the slide-valves of engines, so as to prevent the pressure of the steam from acting on the back of the valve; and by this means economising a considerable amount of power that is now expended in working the valves. The invention relates, secondly, to an arrangement and construction of parts of a locomotive engine and its appurtenances, whereby a powerful blast of heated air may be directed on to the rails, when slippery from damp or frost, so as, by quickly drying them, to allow the driving-wheels of the engine to take a proper hold on the rails. Under this head is also included a novel mode of communicating motion from the driving-wheels to the leading and trailing-wheels of an engine, for the purpose of effecting the same object, viz., to cause the wheels to bite the rail. The third part of the invention relates to the adaptation of additional water spaces to the boiler, so as to economise, as much as possible, the heat given out from the fire.

Under the present system of working the valves of engines, the wear on the moving parts of the valve, and the power expended in actuating the valves, is very considerable, owing to the pressure of the steam on the back of the valves:—in

ordinary locomotive engines this pressure on the valves amounts to about 100 lbs. on the square inch. By the improved construction of valves, forming the first head of this invention, these objections are designed to be obviated.

In Plate VII., the mode of carrying out the objects of this invention is shewn in several views. Fig. 1, represents a longitudinal vertical section of a steam-cylinder, with the improved valve applied thereto; and fig. 2, is a plan view of the valve, with the cover and some of the other parts removed, in order more clearly to shew its internal construction. The valve-box is shewn at *a, a*; and *b, b,* is the slide-valve, which is actuated in the ordinary manner. *c, c,* are four studs, screwed into the side of the cylinder, for the purpose of supporting the cast-iron plate *d, d*; the under side of which is planed and ground true, to lie flat upon the top of the back-plate *e,* of the valve. The cast-iron plate *d, d,* rests upon the nuts *f, f*; the faces of which are accurately ground, so as to correspond exactly to the upper edge of the back-plate *e,* of the valve. The plate *d,* is secured, in its proper place on the studs *c, c,* by other nuts *g, g,* which hold it firmly down on to the nuts *f, f,* beneath. Instead of the valve being solid, as usual, a recess is made therein to receive a plate *e,*—an edge being left all round for the purpose of preventing the plate from shifting or moving out of its place. The upper surface of the plate *e,* is made flush with the projecting edges of the valve, and works against the under side of the cast-iron plate *d.* In order to compensate for the wear of the plate *e,* and to cause it always to bear with an equal pressure against the plate *d,* coiled springs *h, h,* are placed beneath the plate *e,* in holes made for that purpose in the back of the valve. By this means the friction of the valve will be greatly reduced; as it will merely consist of the friction of the plate *e,* against the plate *d.* The other parts shewn in the figure are such as are well known and in use; they do not, therefore, require any detailed explanation.

The patentee remarks, it will be evident to any intelligent engineer (as indeed practice has proved) that there is not sufficient friction to wear away above the thickness of a sheet of paper from the edge of the valve with a twelve-months' fair work; and that, when this small wear has taken place, the narrow edge of the box, round the back-plate *e,* will not receive a greater amount of pressure from the steam than the original screw pressure with which the engine started when new.

The above description refers exclusively to valves applied to cylinders of the ordinary construction; but, in the case of

new cylinders, the patentee sometimes, for facility of manufacture, makes the valves circular instead of "square." In cases where it is considered desirable, a hole may be cast in the centre of the valves and plates, so as to exhaust through the back of the valve direct into the blast-pipe; and where the valve works on the top of the cylinder the steam-chest lid may be made use of as a surface-plate; but the use of the screw-studs and independent cast-iron plate *d*, above described, is preferred. When circular valves are employed, the inside and outside lines of the steam and exhaust ports must be described with the same radius as the outside diameter of the slide-valve; and the work must be all kept perfectly parallel to the face of the cylinder.

At figs. 3, and 4, two views of a new cylinder, with the valve applied thereto, are shewn. Fig. 3, is a longitudinal vertical section, taken through the cylinder and valve; and fig. 4, is a plan view of the valve, with the top plate removed: as similar letters of reference are marked upon corresponding parts of these and the preceding figures, the same description will, in a great measure, apply to this modification.

Fig. 5, is a longitudinal section of a pair of cylinders, with the valve-box and valves constructed according to the present improvements, and placed between them. Steam is admitted to the valve-box (between the two valves, which are protected from pressure, as in the former arrangement), and from thence the steam passes through the valves into the cylinders, as usual; and, after exerting its elastic force therein, is passed out through the exhaust-pipes into the exit-pipes. The construction of the valves is identical in principle with those already described.

The second part of the invention, which relates to the means of causing the driving-wheels of locomotive engines to bite the rails, is shewn at fig. 6; which represents a longitudinal section of some of the principal parts of a locomotive engine, with the improvements adapted thereto. An air-chamber A, is made at the lower part of the smoke-box, and is supplied with air through the pipe *p*, by means of a pump *o*, which draws in air through the mouth-piece *n*, as shewn by the arrow, and forces it into the chamber A. The air is heated in this chamber, and also in a supplementary chamber B, above, which communicates with it by means of the pipes *q*, *q*. The chamber B, is furnished with a safety-valve to regulate the pressure of air in the chambers A, and B. From the chamber B, the heated and compressed air passes along a pipe *s*, furnished with a cock or valve *t*, which is worked by a long

rod *u, u*; so that the engine-driver, by simply pulling this rod, may cause the heated air to pass down the pipe *s*, and be conducted on to the surface of the rails; which, by the powerful blast of heated air, will be almost instantaneously dried.

Another means of causing the wheels to bite the rails, consists in connecting the driving to the leading and trailing-wheels in such a manner that they shall all be made to rotate simultaneously, and, by thus increasing the friction on the rails, cause the engine to be propelled more easily. The means for effecting this object is shewn, in side elevation, at fig. 7. To the driving-wheel a double pulley or band-wheel *v*, is secured; and, on the side of the leading and trailing-wheels, similar pulleys *w, w*, but of smaller diameter, are secured. A band, cord, or chain *x*, is passed once round the innermost groove of the pulley *v*, then round the trailing-wheel, then once round the outer groove of the pulley *v*, and after passing round the pulley of the leading-wheel, it terminates at the driving-wheel. A friction-wheel *y*, adjustable by a screw from above, is provided, to tighten the band or chain *x*, upon the pulleys. By this arrangement it will be seen that, when the band *x*, is tightened, the driving-wheels cannot rotate without causing the leading and trailing-wheels to rotate also; and this additional action on the wheels will be sufficient, under most circumstances, to cause the engine to proceed.

The last part of the invention relates to the means of supplying hot water to the boiler, and consists in making a water-space, several inches wide, round three sides, and under the bottom of the ash-pan, so as to utilize the heat that radiates therefrom. At fig. 6, D, is the water-space, constructed under the ash-pan, and at the back and sides thereof. It communicates, at one end, with the tender, by means of the pipe *z*, which supplies the space with cold water; and, after the water has abstracted a considerable portion of caloric from the heated surface of the ash-pan, it passes, in a heated state, along the pipe *z**, into the boiler.

The patentee claims, First,—constructing the valves of steam-engines with moveable back-plates, which are made to work against a stationary plate, that will take off the pressure of the steam and prevent it from acting on the back of the valve. Secondly,—the plans herein shewn and described, or any mere modification thereof, for drying the rails, or causing the wheels of a locomotive engine to adhere more firmly thereto in damp or slippery weather. And, Thirdly,—the

employment of a water-space beneath and around the ash-pan, for the purpose of warming the water previous to its passing from the tender into the boiler.—[*Inrolled January*, 1851.]

To ROBERT WADDELL, *of Liverpool, in the county of Lancaster, engineer, for certain improvements in steam-engines.* —[Sealed 11th June, 1850.]

THIS invention of improvements in steam-engines consists, firstly, in the application of a novel apparatus to the working cylinders of such machines, or to the steam-pipes thereof, for the purpose of removing water, arising from the condensation of steam, from the priming of the boiler, or from other causes. This is effected by the application of a valve or valves, so arranged as to be closed during the ordinary working of the engine by pressure of the steam; but which valves, upon an accumulation of water, open by reason of the gravity thereof, and admit of its escape. The invention consists, secondly, in an arrangement of apparatus for governing the velocity of steam-engines. By this arrangement an additional throttle-valve is used; which, when the engine is running above its speed, is brought into operation by the variation which then takes place in the pressure of the steam, at different parts of the steam-pipe.

In Plate VII., fig. 1, represents, in section, the working-cylinder and steam-pipe of an engine, upon the horizontal construction, with the improvements applied thereto; and, in order to point out a variation in the method of carrying out the same, a different form of apparatus is applied to either end of the cylinder. To the end A, of the working-cylinder, is attached a chamber *a, a,* and a communication made between the two by a passage *b, b.* Within the chamber *a, a,* are placed two valves *c, c**, which are connected together by a rod *d,* and move simultaneously in an upward or downward direction: these valves are ground and fitted to seats *e, e**, formed upon the chamber *a.* The bottom valve *c**, is provided with projecting pieces *f, f,* (see the detached plan view, fig. 2,) which, by working against the sides of the cylinder *a, a,* act as parallel guides; and a similar provision is obtained at the upper part, by making the valve *c,* cylindrical, but loose enough in the chamber *a,* to allow of a slight escape of steam when the valve is from its seat. To the upper part of the rod *d, d,* is attached a cap *g,* which prevents dirt or other extraneous matter from passing through the aperture

in the chamber *a, a,* and also serves to keep the valves from falling too far. Upon the cylinder *a,* is affixed a bracket, which carries, upon a centre-pin, a lever *i,*—one end thereof being provided with a counterbalance weight *j,* and the other with a fork, which embraces the rod *c;* such fork abutting against the cap *g,* and the boss of a handle *k.* The weight mounted upon the lever *i,* is so adjusted as to counterbalance the valves *c, c*,* and the parts immediately connected therewith: if, therefore, the areas of the said valves be equal, they will remain in contact with their seats, notwithstanding the pressure of the steam, which acts upon their surfaces by passing through the passage *b, b.* In order, however, to ensure this condition, the outward part of the bottom valve *c*,* may be of an area slightly exceeding that of the inward part thereof—by which arrangement an advantage is given to atmospheric pressure, which secures the desired effect—or the weight *j,* of the lever *i,* may be slightly more than necessary to counterpoise the valves and their appendages. The operation will be as follows:—During the proper action of the engine, the valves *c, c*,* will be kept to their seats,—an equilibrium being established, as before described; but, upon water becoming present in the working cylinder, either from condensation, priming, or other cause, it will flow through the passage *b,* into the chamber *a,* and, by accumulating, force down the valve *c*,* from its seat, and open a passage for the exit of the water: as soon as this has been effected, the equilibrium will be restored, and the aperture again closed. Upon the opening of the valve *c*,* the upper one *c,* will, of course, be carried from its seat, and there may be a slight escape of steam, but not such as will be of any material consequence. In order to prevent the valves *c, c*,* from sticking, the handle *k,* may be occasionally turned, so as to cause them to revolve in their seats.

A modification of this arrangement is shewn as applied to the end B, of the working-cylinder. In this instance, within the chamber *a, a,* there is placed a hollow vessel *l, l,* the lower end of which is provided with a pin, capable of moving in a guide *m;* it is also furnished with a valve *c*,* suitably adjusted to a seat formed in the bottom of the chamber *a, a;* and the upper part of the vessel is provided with a valve *c,* which is of an area slightly superior to the outward surface of the bottom valve *c**: by which means, a tendency is given to the valves to rest in their seats. Upon water being present in the working-cylinder, it will flow through the passage *b,* into the chamber *a, a,* and, by accumulating, will cause the

vessel *l*, to float upwards and lift the valve *c**, from its seat, and provide a passage for the exit of the water.

At fig. 1, the improvement is also shewn as applied to the steam-pipe; for which purpose, a chamber *n, n*, is connected thereto, and provided, at its upper and lower parts, with pipes *o, p*; to each of which, respectively, are fitted valves *c, c**, connected by a rod *d*, in a similar manner to the arrangement first described;—in this instance, however, there is a spiral spring *q, q*, placed within the cap *g*, which serves to counterbalance the weight of the valves, &c., instead of the weighted lever before described. The design of this apparatus is to receive the water as it passes along the steam-pipe; in order to effect which, the chamber *n, n*, extends below the bottom thereof; the water will, therefore, fall down the pipe *p, p*, and act upon the valve *c**, as already described; and, to assist in arresting the passage of condensed steam, or other water, a projecting-bar *r*, is placed across the chamber *n*.

Fig. 3, represents a modification, which may be employed in place of that last described, by connecting the pipe *p*, to a chamber similar to that shewn at *n*; through which pipe the water will then pass, and, by floating up the hollow vessel *l*, (as described with reference to the apparatus B,) open the valve *c**, and allow the water to escape.

The second improvement is shewn, as applied to a steam-pipe, at fig. 4. A, is the pipe; connected to which, is a cylinder B, having steam-ports C, D, which form communications with the pipe. The cylinder B, is provided with a piston E, the rod of which passes through a stuffing-box, formed in the bottom of the cylinder, and works in a guide F. One end of a lever G, is connected, by means of a pin and slot, to the rod of the piston E, and is also attached to the spindle of a throttle-valve H, similar to those of the ordinary construction; and, upon this spindle, is also mounted a weighted lever I, serving to counterbalance the piston E, and its appendages.—J, is the ordinary throttle-valve

The operation of the apparatus will be as follows:—While the engine is working at its proper speed, the various parts will be in the position shewn in the drawing,—the pressure being equal on both sides of the piston E, and, consequently, retaining it in a fixed position; and the throttle-valves H, and J, will be so situate, as to admit of the required number of strokes being performed. But should the engine, by any sudden release from resistance, run off at an undue rate, the steam in the pipe A, will become what is called "wire-drawn," and the elastic force thereof will be greater on that side of the

throttle-valve J, which is nearest the boiler than on the other side thereof;—the consequence of this will be, that a superior pressure will be exerted on the upper side of the piston E, which will then be caused to descend, and, by carrying with it the lever G, will turn the additional throttle-valve H, upon its centre, and so partially close the steam-pipe, and reduce the supply of steam to the working-cylinder. When the engine has been thus brought to the required speed, the steam will have regained an uniform pressure, and the counterbalance-weight on the lever I, will raise the piston E, to its former position.

In reference to this part of the invention, the patentee remarks, that the additional throttle-valve may be used either when that of the ordinary construction is connected to a governor, or when it is used with hand-gear, as in marine engines.

The patentee claims, Firstly,—the use of a valve or valves, capable (for the purpose above set forth) of acting by the gravity of the water intended to be discharged. Secondly,—the application to steam-engines of a throttle-valve, capable of being brought into action by a difference in the elastic force of the steam existing at the same time in the steam-pipe.—[*Inrolled December,* 1850.]

To WILLIAM MAC LARDY, *of Manchester, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.*—[Sealed 12th June, 1850.]

THIS invention relates, firstly, to that machine commonly known, in the preparation of cotton and other fibrous materials, as the "drawing-frame," and consists in a peculiar arrangement of "spoon," or conductor of the "stop-motion;"—the essential feature of such arrangement being, the employment of two or more surfaces over which the cotton or other fibrous material passes,—whereby opposite sides of the sliver are brought in contact with the spoon.

Secondly, the invention refers to those machines used in spinning and doubling, commonly known as "throstle-frames" and "doubling-frames," and consists in connecting the spindle to the warve, used for driving the same, in such a manner that it may be lifted therefrom, so as to admit of the bobbin being doffed by passing it over the bottom part of the spin-

dle: this provision admits of a top bearing being applied to a spindle made all in one piece, and having its driving-warve below the copping-rail, as usual; and thus a great steadiness of action is obtained.

Thirdly, the invention relates to that apparatus used in spinning which is commonly known as the "ring and traveller" method. In the ordinary method of ring-spinning, the bobbin is driven positively and at an uniform rate of speed, and the "traveller" caused to revolve round the ring by the traction of the thread of yarn which is being spun,—that is to say, the thread pulls the traveller round the ring as the bobbin revolves; also it is the traction or pulling of the traveller round the ring that forms what is technically called the "drag," and thus lays the yarn or material on to the bobbin as it is spun and delivered from the rollers. The improvement relating to the ring and traveller consists in driving the traveller round the ring positively; and, instead of the thread pulling the traveller round the ring, as in the ordinary "ring-throstle," the traveller will, in this case, pull the thread and bobbin precisely in the same manner as the thread passing through the curl of the ordinary flyer does.

In Plate VIII., fig. 1, represents, in side elevation, one form of the improved spoon; and fig. 2, is a plan view of the same. The spoon rests, as in the common arrangement, upon the fixed bar *a*, as a centre,—such bar running along the side of the frame, to carry the necessary range of spoons. The short lever *b*, has, formed upon its upper end, the usual guide-spoon or mouth *c*, through which the sliver passes, in the direction of the arrows; but, in addition to this guide, a second conductor is formed at *d*, of a tubular or trumpet-shape. The plate *e*, over which the sliver passes in entering the spoons, is, in this arrangement, elevated sufficiently to cause it to bear against the upper side of the trumpet-mouth *a*, whence it passes over and acts upon the conductor *c*, in the usual way. In this manner, a duplex action is produced upon the sliver, so that the spoon may be held up out of contact with its stopping mechanism at a greater angle than is usual; and hence it possesses much more certainty of falling and stopping the frame when the sliver or slivers break and cease to act upon the conductor. The conductor is mounted in the ordinary way,—it being supported on the bar *a*, and guided in the slotted plate *e*. The full lines in fig. 1, represent the conductor as it stands when the drawing-frame is in action and the sliver or slivers are passing through in their unbroken complete state. Should one or more, however, give way, the

necessary tension being removed from the conductor, it will be no longer held in this position, but will fall backwards, as represented by the dotted lines. In this position, the back of the lever *b*, has arrived against the front edge of the longitudinal traversing-plate *f*, which has a series of notches or recesses formed in it, one for each conductor. This plate *f*, has a constant traversing motion, immediately behind the line of conductors, but works clear of them when they are held up by the slivers; when either of them, however, falls, its lever enters a corresponding notch in the traversing-plate *f*, and, by preventing its usual traversing motion, effects the stopping of the machine, as is well understood.

Fig. 3, represents, in elevation, a modification of the "duplex spoon" or conductor; and fig. 4, is a corresponding plan view. This conductor acts in a manner precisely similar to that already described; but the duplex action is secured by a slightly different form of parts,—the sliver being passed from its plate *e*, beneath a projecting angular arm *d*, and thence over the second spoon *c*. In this arrangement, the second action is obtained by the upward pressure of the sliver against the lower side of the arm *d*, which acts as the additional conductor. The same form of duplex spoon is represented in fig. 5, as adapted to a balanced lever-conductor, carried on pivots at *a*. The sliver passes beneath the angular arm *d*, and thence over the guide *c*, as before. When the sliver gives way, the upper part of the spoon being heavier than the lower, the lever falls back, and the catch *g*, on the lower end, advancing forward in the direction of the arrow, enters one of the bars or detents of the constant revolver *h*, as is well understood.

The second part of this invention is shewn at figs. 6, 7, and 8;—fig. 6, being a representation, in elevation, of a spindle and flyer, with the parts immediately connected thereto; and figs. 7, and 8, detached views of the driving-warve. The upper part of the spindle *a*, *a*, is formed of an enlarged diameter,—which part is mounted to run in a top bearing-rail *b*; and the lower end is supported in a step *c*, as usual. The driving-warve is shewn at *d*, and is provided with two collars or bushes *e*, *e**, turned true, and mounted in suitable bearings formed within the bolster-rails *f*, *f*, so as to be capable of revolving therein. A square socket *g*, is formed within the warve, and the lower part of the spindle is suitably squared for passing freely through the same into its footstep-bearing; so that the two are caused to revolve together, but in independent bearings, and are easily separated by the lifting of

the spindle upwards until the footstep is free of the warve. The upper part of the spindle *a*, is formed tubular, in order to provide a passage for the material to the flyer, which is of the ordinary construction, but is made permanently fast on the spindle, and placed so far downward from the top bearing as to allow of the spindle being lifted sufficiently upward to be clear of the bush *e**, of the warve *d*. The copping-rail is shewn at *i*, *i*, and is notched out at the front part thereof, to admit of the spindle being angled outwards. To effect the doffing operation, the spindle *a*, must be lifted upwards, until its footstep is brought above the bush *e**, of the warve; by which movement its smaller diameter will be coincident with the top bearing *b*; which position will admit of the spindle being angled, so as to remove it from the notch in the copping-rail, and so far outward as to admit of the bobbin being drawn off in a downward direction.

The last part of the invention is shewn at figs. 9, and 10; fig. 9, being an elevation of a spindle, and the parts in immediate connection therewith, and fig. 10, a plan or horizontal view of the same. The spindle is represented at *a*, *a*, carried upon a step *b*, and supported within the bolster-rail *c*. The bobbin *d*, is loose upon the spindle, and revolves, as in ordinary throstle-frames, upon a friction washer. In this case, however (as in other modifications of the ring and traveller principle), it is not moved up and down in order to distribute the yarn upon its periphery. The copping-rail is shewn at *e*, and carries a ring *f*, *f*, fitted with a traveller *g*: the interior diameter of the ring *f*, is sufficiently large to admit of the legs of the flyer *h*, revolving freely therein. The flyer is attached to the top of the spindle *a*, *a*, and, instead of the legs of the flyer being provided with the curl commonly in use for guiding the passage of the yarn, the traveller *g*, is made to answer that purpose. This traveller *g*, is formed with a projecting piece, which extends inwards sufficiently to prevent the flyer from revolving without carrying the traveller round the ring *f*, at its own uniform speed. The yarn under operation passes in the usual manner through the rollers of the machine, and from thence through the loop of the traveller *g*, and on to the bobbin *d*; and the copping-rail *e*, by rising and falling, distributes the yarn upon the periphery of the bobbin, as it is wound thereon by the drag of the bobbin, in precisely the same manner as with the ordinary spindle and flyer. As the copping-rail rises and falls, the projecting part of the traveller in contact with the flyer will, at all positions, be coincident with the circle in which the legs of the flyer revolve.

The patentee states that, by this method of spinning, the advantages of the ring and traveller principle are united with those of the ordinary throstle; for it will be observed, that the traveller may be considered as the usual curl of the flyer, with a provision for its being traversed upward and downward, in order to distribute the yarn; and, therefore, the same effect will be produced with a spindle of considerably reduced length above the bolster-bearing. If desired, a disc or ring of metal, or other suitable material, may be placed upon the upper part of the flyer, as shewn at fig. 11, in order to keep the yarn, as it passes to the traveller, from bearing against the top of the bobbin.

The patentee claims, Firstly, with reference to those machines commonly known as drawing-frames,—the application to the stop-motion spoons, of two or more surfaces, in contact with which the sliver of cotton or other material passes. Secondly, with reference to throstle-frames and doubling-frames, he claims so connecting the spindles to the warves, by which they are driven, that the said spindles may be lifted free from the warves, for the purpose of doffing the bobbins; and also the mounting of the driving-warves of throstle-frame and doubling-frame spindles in independent bearings, for the purpose of preventing vibration. Thirdly, in reference to that mode of spinning called the ring and traveller, he claims the new system of driving the traveller positively round the ring by means of a revolving-flyer, or other suitable instrument.—[*Inrolled December*, 1850.]

To Robert Heath, *of Manchester, in the county of Lancaster, iron merchant, and* Richard Handley Thomas, *of Wolstanton, in the county of Stafford, engineer, for certain improvements in the manufacture of iron.*— [Sealed 19th June, 1850.]

This invention relates particularly to the conversion of "puddled" balls of iron into what are commonly called "blooms;" and the peculiar feature thereof consists in a novel arrangement of two revolving surfaces, between which the iron, intended to be worked, passes,—such surfaces being connected to suitable gear, so as to revolve in the same direction, the one at a speed above that of the other; by which means, the material under operation is rolled, so as to turn upon its own centre, and is, at the same time, carried downwards, to be discharged at the lower part of the apparatus: this machine

is also applicable to the rolling of iron into other forms than that of the ordinary bloom, as hereafter described.

In Plate VII., fig. 1, represents a side elevation of the machine; fig. 2, a plan or horizontal view thereof; and fig. 3, an end elevation of the same. The framework (affixed to a bed-plate in any ordinary manner) is shewn at *a, a*; upon which are mounted, in suitable bearings, the two revolving surfaces *b, b**. These surfaces are of iron, and are grooved or fluted, as shewn in the drawing. To the axle of the one *b*, is affixed a toothed wheel *c*; and to that of the other *b**, a toothed wheel *d*, driven by a pinion *m*,—the shaft of which is connected to any suitable motive power. The wheel *d*, is of smaller diameter than that shewn at *c*; the revolving surface *b**, to which it is connected, will, therefore, move at a rate above that of the other *b*. Upon the upper part of the framework of the machine is mounted a sliding-piece *e*, which is capable of moving in V-guides *f, f*. The inward end of the piece *e*, carries a projecting part or "upsetter" *g*, which is so formed as to fit the peripheries of the revolving surfaces *b, b**,—in contact with which it is capable of moving, so as to form an abutment, against which the iron under operation presses, in order to effect a perfect end to the bloom. The outward part of the sliding-piece *e*, is connected to a lever *h*, which is attached to a vibrating-shaft *i, i*, mounted in suitable bearings attached to the framework of the machine. This shaft carries, at either end, a lever *j*; and these levers are provided, at their extremities, with a weight *k*; by which means, the shaft *i, i*, is turned forcibly upon its centre, and the sliding-piece *e*, (through the intervention of the lever *h*,) is pressed forward towards the opposite sides of the revolving surfaces *b, b**. On the contrary side of the machine to that occupied by the sliding-piece *e*, the framework *a, a*, projects upwards; and, in such projection, is formed a dovetail-groove, which receives a similarly-formed piece *l*, adjusted so as to bear lightly against the sides of the revolving surfaces *b, b**: this forms an abutment for the material under operation, and may be removed, when worn, for the substitution of another.

The operation of this machine is as follows:—The iron, puddled in the usual manner, is placed between the revolving surfaces *b, b**; and the sliding-piece *e*, is pressed forward by the weights *k, k*, so as to be partly across the peripheries thereof. The machine being now put in motion, the material will be rolled round upon its own centre; the superior velocity of the surface *b**, at the same time carrying it downwards: during this operation the metal will be extended in length,

and the sliding-piece *e*, will be forced back against the pressure generated by the operation of the weights *k*, *k*; whereby a perfect end to the bloom will be maintained, so as to produce one of a regular figure. In the position shewn in the drawing, the bloom is partially formed,—the slide *e*, having been forced backwards, as before described. When the metal, under operation, has passed the line coincident with the centres of the revolving surfaces, it will fall to the lower part of the machine, and may be removed therefrom in any desired manner. As the bloom is in progress of being formed, the refuse matter, which will be separated therefrom, may fall on to a grating provided for that purpose, and thus pass into a receptacle for removal at pleasure.

The patentees claim the use of revolving cylindrical surfaces or rollers, moving in the same direction (as shewn in the drawing by arrows), for the purposes above set forth.—[*Inrolled December*, 1850.]

To HENRY PRATT, *of New Bond-street, in the parish of St. George, Hanover-square, in the county of Middlesex, camp equipage manufacturer, for improvements in the construction of portmanteaus and travelling trunks.*—[Sealed 9th July, 1850.]

THIS invention has for its object a more convenient and useful arrangement of the several parts of a portmanteau or travelling trunk than is usually found in these articles.

In Plate IX., fig. 1, represents a longitudinal vertical section of the improved portmanteau,—shewing some of the compartments open; and fig. 2, is an end view of the same. The body or fixed frame of the portmanteau or trunk is seen at *a*, *a*. The portmanteau is divided, at its upper part, into two compartments *b*, and *b**; and the cover being jointed in the middle, at *c*, to the centre upright of the frame, either of these compartments can be opened without interfering with the other. Beneath one of the boxes *b*, is a hat-case *d*, which is removable; and, when removed, leaves an open space or compartment, of convenient size, for the reception of various articles. A similar vacant space is made at *e*, beneath the other compartment *b**. The two compartments *d*, and *e*, are divided from each other by a fixed central partition *f*; but, if required, this partition may be hinged at bottom, and made to fall down and throw the two compartments into one. One of the ends *g*, of the portmanteau is also hinged at bottom,

and is secured to the lower part of the framing; and, when open (as shewn at fig. 1,) gives access to two drawers *h*, and *h**, which extend from end to end of the portmanteau beneath the compartments *d*, and *e*. The upper drawer is shallower than the other, and is intended to hold shirts and other flat articles, which are liable to become crumpled in the more confined and shorter compartments above. The lower drawer *h**, is intended to receive coats, trousers, and other outer garments, and is therefore made deeper than the upper one.

Fig. 3, is a longitudinal vertical section of a modification of the above;—both the ends *g*, and *g**, of the portmanteau being, in this instance, hinged, and capable of being let down when required, as shewn by dots in the figure. By this arrangement, the drawers may be made to pull out at either end. A short drawer is also placed in one of the upper compartments *d*, or *e*; and, when that is the case, the central partition is fixed. In constructing this portmanteau, it will be found convenient to make the ends *g*, *g**, and the bottom, of one piece of leather: the top may also be made of one piece.

In constructing a lady's portmanteau or travelling wardrobe, a similar arrangement is adopted,—the principal difference being, that the front of the wardrobe falls down, in the place of one or both ends, as already described. The drawers, of course, instead of being long and narrow, as in the former instance, are as wide as the wardrobe is long. The separate compartments *d*, and *e*, (as shewn in the former figures) are dispensed with, and form one large compartment, for the reception of bonnets, caps, and other light articles. In the lady's portmanteau, the top part, although divided into two compartments, is not jointed transversely across the middle, as in the other instance, but is divided lengthwise, so as to form two compartments the whole length of the portmanteau, instead of two nearly square ones, as in the gentleman's portmanteau. The ends of the gentleman's portmanteau and the two sides of the lady's portmanteau are held up, in a vertical position, by means of a brass clip or clasp, so as to prevent the said ends from falling down when the lid or top part is lifted up to get at any of the upper compartments. The handles, whereby the portmanteau is lifted, are not affixed to the portmanteau itself, but are attached (as seen at *i*, *i*,) to a strap *k*, which is secured in the middle, at *l*, to the iron centre-bar of the framing. This strap *k*, is furnished at each end with a strong buckle, which is held down by a strap *m*,

fig. 3. Additional handles may be attached, if required, to the sides of the portmanteau.

The patentee claims constructing portmanteaus or travelling trunks, or wardrobes, with double lids, jointed in the middle, and made to open from opposite ends or sides; such portmanteaus or travelling trunks having separate compartments and drawers, in which various descriptions of articles and wearing apparel may be placed, and kept separate from each other, as above set forth. He also claims attaching the handles to straps, as above described, instead of to the portmanteau itself, as is usually the case.—[*Inrolled January,* 1851.]

To Isaac Hartas, *of Wrelton Hall, in the county of York, farmer, for an invention of improvements in machinery for obtaining motive power,—being a foreign communication.* —[Sealed 19th June, 1850.]

This invention relates to an improved arrangement of mechanism for obtaining motive power from the muscular exertion of horses and other animals, and is intended principally to be employed for driving machinery for agricultural and other like purposes.

In the machine which forms the subject of the present invention, the horse or other animal is made to tread on a travelling endless floor, which communicates motion to a shaft, round which it moves, and thereby (through the intervention of any convenient gearing) communicates motive power to the machine to be driven. The patentee remarks, that the mechanism hitherto employed for obtaining motive power for driving machinery, by means of horses or other animals actuating a travelling endless floor, is open to several serious objections; and, among others, it has been found that, if the horse is suddenly stopped, either the mechanism becomes deranged, by some undue strain thereon, owing to the exertion of the horse to stop the machine (which will continue in action for a short time by the momentum gained by the fly-wheel), or there will be great liability for the horse to be thrown down and injured. Now the object of the present improvements is to obviate these inconveniences to which the old arrangements are liable.

In Plate VIII., fig. 1, represents a side elevation of the improved engine,—some of the parts being cut away, in order that the interior arrangement may be more clearly seen; and

fig. 2, is a plan view of the same. *a, a,* is the framework; and *b, b,* is the travelling endless floor, furnished with pulleys or rollers, which run on rails on each side of the machine as usual, and also provided with a chain-plate or flexible toothed rack *e,* which gears into a toothed wheel *f,* on the driving-shaft *g.* If required, there may be one of these wheels on each side of the machine; and both are to be firmly secured to the shaft. A cylindrical box or case *h,* is also secured in any convenient manner to the shaft *g.* Inside this box is fastened a pawle or click *i,* which is kept in contact with the teeth of a ratchet-wheel *k,* by means of a spring *j.* This ratchet-wheel *k,* is mounted on a hollow shaft *l,* which also carries the fly-wheel *m,* and revolves freely on the driving-shaft *g*: the arrangement and construction of this part of the mechanism will be best understood by referring to the detached sectional view, fig. 3. It will now be understood that, as the horse moves the travelling-floor under him, he will drive round the toothed wheel *f,* and the shaft *g,* on which it is fixed, together with the cylindrical-box *h,* and its pawle or click *i*; and, by means of the latter acting against the teeth of the ratchet-wheel *k,* the hollow shaft *l,* and fly-wheel *m,* will be driven round; and all the parts will continue to rotate together as long as the horse keeps in motion. When he stops, the travelling-floor will stop, as will also the driving-shaft and the cylindrical-box *h,* and pawle *i*; but the fly-wheel, having acquired a certain amount of momentum, will however continue to rotate and carry round with it the hollow shaft *l,* and ratchet-wheel; but, as neither of these parts are fixed to the driving-shaft *g,* their continued rotation will not of course have any effect upon the stationary parts,—as the teeth of the ratchet-wheel will pass under the click, which is the part that drives the wheel when all the parts of the machine are in motion. It will therefore be seen, that no derangement of parts, and no inconvenience can arise from the continued rotation of the fly-wheel. On the opposite side of the machine to that shewn at fig. 1, a brake-wheel *n,* is keyed to the driving-shaft, for the purpose of controlling the speed and stopping the machine by means of a friction-brake, when required: this friction-brake consists of a weighted lever *o,* furnished with a block, which fits the periphery of the friction-wheel. To one end of the lever *o,* is attached a cord, which passes over pulleys, and is secured, at the opposite end, to a hand-lever *p,* which may be held to any point by means of a sector ratchet-rack, so as to take off, or put on, the friction-brake at pleasure.

Figs. 4, and 5, represent a somewhat different arrangement of parts,—the principle, however, being precisely the same; and, as the same letters of reference are marked on corresponding parts throughout the figures, it will be unnecessary to give any detailed description thereof. It may be well, however, to observe, that, instead of placing the driving-shaft at or near the middle of the machine, and driving it by means of a chain or rack acting upon a toothed wheel, the travelling-floor passes over two pulleys, one at each end of the machine; and the axle of the large pulley forms the driving-shaft,—thereby somewhat simplifying the arrangement.

The specification also shews an arrangement wherein the travelling-floor is passed round two wheels or rollers, the peripheries of which are made angular, to fit the under side of the floor, which is driven by the angular parts of the rollers being made to act on the chain, instead of causing projections or teeth on the rollers to take into openings in the chain of the travelling-floor, as in the former instance. The travelling-floor is further supported by a series of antifriction-rollers, secured to any convenient part of the frame.

The patentee claims making the fly-wheel and its appendages independent of that part of the mechanism which is acted on by the animal; so that when the horse or other animal and the travelling endless floor are stopped, the fly-wheel and its appendages may continue to rotate without inconvenience or risk of deranging the machinery.—[*Inrolled December,* 1850.]

To James Forster, *of Liverpool, merchant, for improvements in filtering water and other liquids.*—[Sealed 27th June, 1850.]

This invention consists, firstly, in an improved apparatus for filtering water and other liquids; and, secondly, in cleansing or purifying the filtering material by chemical means, after it has been rendered foul by use.

In Plate VIII., fig. 1, is an external elevation of the filtering apparatus; fig. 2, is a vertical section; and fig. 3, is a plan view thereof. *a*, is a hollow spherical vessel, composed of porous stone or other suitable porous material, and enclosed within a strong close vessel *b*. The vessel *a*, is made in two parts, which are securely connected together by cement or other suitable means; and the patentee prefers to construct the vessel *a*, in the form of a sphere, but he does not confine

himself to that shape. To the top of the vessel *b*, is affixed a pipe *c*, through which the water, or other liquid to be filtered, is introduced, by means of a force-pump, or supplied from a main pipe, into the space *d*, between the inner surface of the vessel *b*, and the outer surface of the vessel *a*; and, by the pressure exerted, the water or other liquid is forced through the porous substance of the vessel *a*, into the interior thereof; and the filtered water is drawn off therefrom through the cock or tap *e*: the filtration and discharge of the water or other liquid will thus depend upon the pressure exerted; as there is no aperture for the admission of air into the apparatus. At the bottom of the vessel *b*, a cock *f*, is affixed, for the purpose of drawing off unfiltered water or any liquid which may be employed for cleansing the filter.

The patentee says, he is aware that filtering vessels have before been made of stone and other porous matters, and placed in cisterns or other open vessels,—the water flowing from the porous vessel by the use of suitable air-pipes or passages; he does not, therefore, claim the same; but states his invention to consist in the mode, above described, of combining a porous vessel *a*, with a closed vessel *b*, and suitable taps or outlets, so that the filtration and discharge of the water or other liquid shall be effected by the pressure of the fluid, as explained. He further states, that although he has described this part of his invention to consist in using only one porous vessel *a*, within another close and strong vessel *b*, yet, for water-works, he recommends that several such vessels *a*, should be placed within one such vessel *b*.

The following are the methods, described by the patentee, for purifying the filtering material by chemical agency:—First, if the pores of the filter should become stopped during the process of filtration by aluminous or clayey matter, the filtering vessel is to be removed from its outer case, and immersed in a boiling solution of dilute sulphuric acid, containing a small quantity of nitrate of potash; after remaining so immersed for from five to fifteen minutes, it is removed; and then the aluminous matters and any free acid are washed from the stone, by passing water through it. The patentee states, that in this process he prefers to use a solution composed of two fluid ounces of sulphuric acid to one pint of water, in which is dissolved a quarter of an ounce of nitrate of potash.

Secondly, if the pores of the filter become obstructed by lime or its carbonate (in the state of chalk), the filtering vessel

is to be treated with a cold dilute solution of hydrochloric acid, in the manner above stated with respect to the solution of sulphuric acid; and the impurities are afterwards to be washed from the filter by the use of water. The solution of hydrochloric acid, which the patentee employs, is composed of two fluid ounces of the acid to one pint of water.

Thirdly, in case the pores of the filter are stopped by oxide or carbonate of iron, the filtering vessel is treated with a dilute solution of hydrochloric acid, formed by adding thereto a similar quantity of water to that just mentioned, and used at the ordinary temperature: the resulting chloride of iron is easily removed by passing water through the filter.

Fourthly, when the pores of the filter are obstructed by oxide of lead, the filtering vessel is immersed in a hot or boiling solution of dilute nitric acid, for ten or fifteen minutes; and, after this, the resulting nitrate of lead is washed out of the filter with water. The solution of nitric acid is made by adding three fluid ounces of the acid to one pint of water.

Fifthly, if the foulness of the filter is produced by carbonaceous or peaty matters, the same may be dissolved by the application of concentrated sulphuric acid, raised a little above the common temperature; and, after such treatment, the dissolved carbonaceous matters may be removed from the filter by boiling in water.

Sixthly, when the filter becomes obstructed by the refuse or more solid impurities of oily or fatty matters, the filter is to be immersed in a hot alkaline solution, consisting of either soda or potash, in which such matters become saponified, and consequently may be easily removed by hot water.

With regard to the above method of cleansing by chemical agency, the patentee says, he wishes it to be distinctly understood that he does not confine himself thereto; as he is aware that there are other acids and alkaline substances than those above named which are capable of removing the impurities resulting from filtration; but there are none, he believes, at present known to chemists, which may be applied so cheaply and effectually as those which he has pointed out. What he claims is, the application of chemical bodies, which act, while in solution, as solvents of those solid impurities which obstruct the action of filters.—[*Inrolled December*, 1850.]

To Charles William Bell, *of Manchester, in the county of Lancaster, for improvements in apparatus connected with water-closets, drains, and cesspools, and gas and air-traps.*—[Sealed 25th July, 1850.]

This invention consists in constructing passages of India-rubber in combination with water-closets, drains, and cess-pools, and gas and air-traps, in such manner that they will permit the passage of sewage and other liquids and matters suspended in them, and also of gases and other fluids, in one direction, and will, by collapsing, prevent the return of vapours or matters in the opposite direction.

In Plate VIII., figs. 1, and 2, are sectional views of a water-closet; and fig. 3, is a plan view of the under side thereof. *a*, is the pan; and *b*, is the pipe by which the soil and water are carried away. The connection between the lower part of the pan and the pipe *b*, is to be made air-tight by any convenient means: the patentee prefers to use a ring of vulcanized India-rubber *c*, for this purpose; but other means of producing an air-tight connection may be employed. To the bottom of the pan is attached a passage *d*, of India-rubber, the lower part of which is made flat, and has at all times a tendency, after opening, to assume a collapsed state; but, when pressed by the fluid above, the collapsed part will open and permit the fluid to pass. In order to make passages, such as *d*, of India-rubber, which will have at all times a tendency to assume the collapsed state, the patentee prefers to take a tube of India-rubber, and to cause the part which is to assume the collapsed state, when in use, to be collapsed, and to be held firmly in that form or state whilst the process of vulcanizing is being performed; or the whole length of tube may be treated in a collapsed state, and part thereof drawn on the tubular bottom of the pan: the collapsed surfaces being kept in contact during the process of vulcanizing, they will, when the process is completed, retain such form or set; and, after being separated, they will again assume the state or form in which they were vulcanized; and the contact of the surfaces will be such as to produce an air-tight joint. Although the patentee prefers to use India-rubber for constructing such passages, he does not confine himself thereto, as other matters may be combined with it, so long as the India-rubber is allowed to retain that degree of elasticity which will cause the surfaces of a passage (such as above described) to collapse when free to do so.

Fig. 4, is a plan view, and fig. 5, a vertical section, of a

grating or trap for sinks and other places, provided with an India-rubber passage *d*, which will permit fluids to pass into drains or cesspools, and yet will prevent the escape of any gas or foul air therefrom through the trap. In some cases, the India-rubber passages may be applied in pipes, as shewn at fig. 6, to act as air-traps; or they may be simply attached to the end of a pipe (as shewn at fig. 7,) which enters a drain or cesspool. These passages may also be applied to air-cushions, and other articles which are required to be filled with air or gas; but, in such cases, some means must be provided for discharging the air or gas therefrom: this may be effected by introducing a tube through the collapsed part of the passage.

The patentee claims, as his invention, the manufacture of collapsable passages of India-rubber, above described, connected with water-closets, drains, and cesspools, and gas and air-traps.—[*Inrolled January*, 1851.]

To James Colman, *of Stoke Mills, Stoke, near Norwich, in the county of Norfolk, mustard and starch manufacturer, for improvements in the manufacture of starch.*—[Sealed 8th June, 1850.]

This invention consists in the employment of a certain salt or salts, or chemical substance or substances, for separating or facilitating the separation of the starch, contained in farinaceous and leguminous substances, from the gluten and other matters with which it is mixed or combined.

The patentee describes the method of manufacturing starch from rice according to his invention, from which the manner of obtaining starch from other farinaceous and leguminous substances, by means of these improvements, will be readily understood. One ton of rice, either whole or broken, and with or without the husks, is subjected to the action of a caustic alkaline ley, in the usual manner;—a ley of soda being preferred to one of potash, because it is less expensive and has not so great a tendency to cause the starch to be deliquescent. When the rice has been steeped in the ley or alkaline solution for a sufficient time to destroy the union of, or diminish the affinity between the starch and gluten contained therein, it is washed and passed through levigating stones in the usual way, whereby it is ground or crushed into a pulp; and this pulp is then introduced into a churn, together with forty gallons of a solution of borax and lime. To prepare the solution, twenty pounds of borax are dissolved in a sufficient quantity of hot

water to form, when cold, a saturated solution thereof (*i. e.*, twenty parts of water to one of borax); forty gallons of this solution are poured upon a bushel of fresh-burnt unslaked lime, the mixture is well-stirred, and as much water is added thereto as will make (with the water previously used) in the whole fifty gallons; then the mixture is allowed to stand until the undissolved portions have either precipitated or risen to the surface; and after this the clear solution is drawn off and added to the pulp. The mixture is agitated in the churn for about three hours, or until the pulpy matter has been properly acted upon by the solution; and then the mixture is transferred from the churn into a separating vessel, and as much water as will be equal to the contents of the churn is added and stirred up therewith. After this, the starch is washed, cleansed, boxed, and dried in the ordinary manner.

In place of using a solution of borax and lime, a solution of bitartrate of potash and lime, or of borax alone, or of bitartrate of potash alone, may be employed in the above process, in the same manner as the first-named solution.

Starch is extracted from other farinaceous and leguminous substances by reducing such substances to a pulp, and then subjecting the same to the process above described.

The patentee claims, as his invention, the application of a solution of borax or bitartrate of potash and lime, or of borax or bitartrate of potash only, to act upon the pulpy matters from which starch is to be separated, and facilitate or promote the separation of the starch from the matters with which it is mixed, in manner above described.—[*Inrolled December*, 1850.]

To WAKEFIELD PIM, *of the town or borough of Kingston-upon-Hull, engine and boiler-maker, for certain improvements in the construction of the boilers and funnels of steam-engines.*—[Sealed 3rd July, 1850.]

THE patentee commences his specification by stating, that tubular boilers, as ordinarily constructed for marine steam-engines, are generally superior to those made with flues; as, by reason of their compact form, the space which they occupy in the vessel is much reduced, and, from their comparative lightness, the draught of water is diminished; and thereby a greater proportion of the tonnage of the vessel is rendered available for commercial purposes, and an increased speed is obtained with the same propelling power. These advantages are usually diminished by the rapid manner in which the

flame and heated gases pass immediately through the tubes, without due circulation, into the chimney; whereby much of the heat which ought to be absorbed by the water in the boiler is lost; and the destruction of the boiler and chimney, and the consumption of fuel, are increased in a corresponding degree. To remedy these evils is the object of the present invention; and the manner in which the patentee proposes to effect this is by giving a double circulation to the flame and heated gases through the tubes, so that their heating influence will be longer exerted upon the water in the boiler: by which means much of the heat which usually escapes up the chimney, in boilers of the ordinary construction, and occasions the rapid destruction of the chimney and an extravagant consumption of fuel, is absorbed and beneficially employed.

In Plate IX., fig. 1, is a longitudinal section, and fig. 2, a transverse section, of a tubular boiler, constructed according to this invention; and fig. 3, is a longitudinal section of a tubular boiler of the ordinary construction: the same letters of reference are used in all the figures to indicate similar parts. *a,* is the furnace; *b, b,* are water-spaces, which divide the tubes *c,* into two distinct tiers; and *d,* is the chimney. In the improved boiler, the flame, instead of proceeding from the furnace direct through the tubes *c,* into the chimney, as in fig. 3, passes first through the lower tier of tubes into the chamber *e,* and thence through the upper tier of tubes into the chimney. The patentee remarks, that the situation and construction of the funnel is altered, as shewn in the drawing, so as to admit of the circulation of the flame according to his invention; but he does not describe any alterations in the construction of the funnel.

In conclusion, the patentee states, that his invention consists in constructing the boilers and funnels of steam-engines so as to give a double circulation to the flame and heated gases, generated in furnaces of marine steam-engines, through the tubes, as above described.—[*Inrolled December,* 1850.]

To Frederick Albert Gatty, *of Accrington, in the county of Lancaster, manufacturing chemist, for a certain process or certain processes for obtaining carbonate of soda and carbonate of potash.*—[Sealed 11th June, 1850.]

This invention consists in obtaining the carbonates of potash and soda by decomposing a solution of the neutral tartrate of potash or soda, by means of carbonic acid gas and lime, or

carbonic acid gas and carbonate of lime, or carbonic acid gas and a mixture of lime and carbonate of lime.

In carrying out the invention, the patentee employs a wooden vessel, of a cylindrical form, capable of holding 400 gallons, and furnished with an air-tight lid. Into this vessel 300 gallons of a solution of neutral tartrate of potash, at 5° Twaddle, are poured, and 34 gallons of lime-milk (each gallon containing 1 lb. of lime) are added thereto: instead of lime, carbonate of lime, or a mixture of lime and carbonate of lime, may be employed; but the patentee prefers to use lime. An agitator is placed in the liquid contained in the vessel, and attached to a shaft, which passes through an air and water-tight stuffing-box, and is provided with a handle, whereby it can be caused to rotate. A stream of carbonic acid gas is passed into the liquid, through a pipe, and mingled with it by the rotation of the agitator; and the supply of carbonic acid gas is continued until the liquid is saturated with it. The operation is then completed; and the contents of the vessel, consisting of a solution of bicarbonate of potash and insoluble tartrate of lime, are run off into another vessel, and allowed to subside. After this, the liquid containing the bicarbonate of potash is drawn off; but, as some of the bicarbonate of potash remains amongst the tartrate of lime, it is requisite to wash it out therefrom. For this purpose, about 50 gallons of water are added to the tartrate of lime, and stirred up therewith; and, when it has subsided again, the clear liquid is drawn off. The operation of washing is repeated a second and third time; and the clear liquid from such washings is subsequently used, instead of water, for the first washing of the tartrate of lime next produced. The bicarbonate of potash, which is drawn off in the first instance after the tartrate of lime has subsided, and the liquid which is drawn off after the first washing, are evaporated to dryness in an iron pan. By this operation, the bicarbonate of potash is changed into subcarbonate of potash, which is then calcined in a reverberatory furnace, in the manner well known to manufacturing chemists. In this state, the carbonate of potash is sufficiently pure for most manufacturing purposes; but, if it is required to be in a more pure state, it is re-dissolved in water, and the clear liquor evaporated again to dryness.

The tartrate of lime, obtained in the above process, may be used in the manufacture of tartaric acid. Carbonate of soda is produced by treating the neutral tartrate of soda in the manner above described with regard to the neutral tartrate of potash.

The patentee claims, as his invention, obtaining carbonate

of soda and carbonate of potash by decomposing solutions of either the neutral tartrate of soda or of the neutral tartrate of potash with carbonic acid gas and lime, or with carbonic acid gas and carbonate of lime, or with carbonic acid gas and a mixture of lime and carbonate of lime, as above described.—[*Inrolled December*, 1850.]

To FRANK CLARKE HILLS *and* GEORGE HILLS, *of Deptford, manufacturing chemists, for certain improvements in manufacturing and refining sugar.*—[Sealed 1st June, 1850.]

THIS invention consists in a process for removing from saccharine solutions any excess of sulphuretted hydrogen or of the hydrosulphurets of the earths which may have been used to precipitate lead or other metals from such solutions.

When sulphuretted hydrogen is the agent which has been used for precipitating lead or other metals from saccharine solutions, and it has been ascertained, by the usual tests, that all the metal is precipitated, and that the solution contains an excess of sulphuretted hydrogen—the patentees add to the solution a quantity of sulphite of lead (made into a cream with water), which immediately abstracts the sulphuretted hydrogen. The solution is kept during the process at a temperature of about 150° Fahr.; and the addition of the sulphite of lead is continued until, on testing part of the solution (which is first to be filtered), it will not change color or become black when a solution of acetate of lead is added thereto. Without the addition of sulphite of lead, the solution would be found to have a most disagreeable taste and smell, owing to the presence of the sulphuretted hydrogen, which also interferes with the process of crystallization. After being treated with sulphite of lead, the solution is filtered, and boiled down to the proper degree for crystallization.

When the hydrosulphurets of the earths have been used, in place of sulphuretted hydrogen, for precipitating lead or other metals from saccharine solutions, the excess of the hydrosulphuret may be removed by the employment of sulphite of lead, or carbonate of lead, or precipitated protoxide of iron.

In cases where sulphuretted hydrogen has been employed for precipitating lead and other metals from saccharine solutions, if the solution be made perfectly neutral or charged with an excess of base, then carbonate of lead or precipitated protoxide of iron may be used instead of sulphite of lead.

The patentees claim, as their invention, the employment of sulphite of lead, or carbonate of lead, or precipitated protoxide

of iron, to deprive saccharine solutions of sulphuretted hydrogen, or of hydro-sulphurets of the earths which may have been employed for the purification of such solutions.—[*Inrolled December,* 1850.]

To THOMAS MILLS, *of Bow, in the county of Middlesex, engineer, for improvements in steam-engines and in pumps.* —[Sealed 22nd July, 1850.]

THE improvements in steam-engines and pumps, which form the subject of this invention, consist in a certain method or certain methods of causing the packing of the pistons or plungers to fit any inequality in the diameter of their cylinders or barrels;—such method or methods affording great facilities for increasing the expanding pressure of the packing during any temporary stoppage of the steam-engine or pump, and without removing the piston or plunger from the steam cylinder or pump barrel.

In Plate IX., fig. 1, is a plan view of a piston provided with the improved packing; fig. 2, is a plan view with the junk ring removed; fig. 3, is a vertical section; and fig. 4, is an edge view thereof, with part of the packing rings removed. *a,* is the body of the piston, and *b,* the junk ring, which are similar to those of the ordinary construction. *c, c,* are the packing rings. *d,* is an inner ring, of nearly the same depth as the two packing rings, and turned so as to bear uniformly against the inner surface of the same. Out of this ring an angular or wedge-shaped piece is cut, as shewn at fig. 4; and in the space, thus formed, is fitted a wedge *e,* (shewn detached, upon a large scale, at figs. 5, which represent front, edge, and plan views thereof) for the purpose of expanding the ring *d,* sufficiently to cause it to bear against the packing rings. Within the wedge a cavity is formed for the reception of a nut *f,* and a spiral spring, which is interposed between the nut and the upper part of the wedge, so as to exert a constant upward pressure upon the wedge, in order to keep the ring *d,* in an expanded state; and this pressure can be increased to any desired extent, without taking off the junk ring or even removing the piston from the cylinder, by turning the screw *f,* (which works in the nut *g,*) and thereby compressing the spring. The screw *f,* extends upwards through the junk ring and terminates in a rose-head, upon which a spring-catch *h,* acts, in order to retain the screw in any desired position. When the packing requires adjustment, the piston is brought to the top of the cylinder, and then the screw is turned by

means of a key, introduced through an orifice in the cylinder cover, which is afterwards closed by a screw. The wedge *e*, may be used without the spiral spring, but not with equal advantage.

When the improved packing is used in oscillating and horizontal cylinders, the back of the wedge should be bevilled, and the recess, made in the piston to receive it, should be formed with a corresponding bevil; so that as the wedge is pressed upwards (on the packing wearing away) the two bevilled surfaces may still keep in contact and impart firmness to the piston. This arrangement will be found particularly advantageous when the wedge is applied to the lower side of the piston in horizontal cylinders. For oscillating cylinders, it is best to place the wedge on that side of the piston immediately opposite the throw of the crank after it has passed the top of the stroke.

Fig. 6, is a transverse section of a piston, furnished with a modification of the above arrangement for expanding the packing; and fig. 7, is an edge view thereof,—part of the packing rings being broken away. *i*, is a thin band or hoop of steel, carrying several bearing-pieces *j*, which press against the packing rings *c*, as shewn in the plan view, fig. 8. A wedge *e*, is used in this arrangement, but without the spiral spring above mentioned; for the band *i*, acts as a spring, which yields in the event of an inequality in the diameter of the cylinder requiring a corresponding expansion or contraction of the packing to take place during the act of making a stroke.

Another modification of the means of adjusting the packing of steam-engines is represented at fig. 9. *k*, is a metal ring, which is expanded by a wedge *e*, similar to those before described; and *l*, *l*, are springs, which are interposed between the ring *k*, and the packing rings *c*.

Fig. 10, is an elevation and fig. 11, a plan view of a pump bucket, constructed according to this invention, and intended to be fitted with hempen packing. *m*, is an expanding metal ring, around which the packing is placed; *e*, is the wedge whereby the ring is expanded; *f*, is the screw by which the wedge is adjusted; and *n*, *n*, are two collars, which are bevilled or dished on the inner side (as indicated by the dotted lines fig. 10,), so as to cause the hempen packing, as it is expanded, to become more compact on the outer surface, where it comes in contact with the pump barrel.

The patentee claims, Firstly,—constructing pistons for steam-engines and pumps with an expanding ring, acted upon by a wedge-shaped piece which acts parallel to the line of motion of the piston, as shewn at figs. 1, 2, 3, 4, 5, and above

described. Secondly,—the two modifications thereof shewn at figs. 6, 7, 8, 9, and above described. Thirdly,—the construction of hempen-packed pump buckets and other pistons in the manner represented at figs. 10, and 11, and above described.—[*Inrolled January,* 1851.]

Scientific Notices.

Reports I. and II. of the Society of Arts Committee for promoting the legislative recognition of the Rights of Inventors.

THE notoriety which the Society of Arts has recently attained by its exhibitions of art manufacture, and more particularly by its connection with the Great Exhibition, would forbid our passing unnoticed the published accounts of its proceedings with respect to Patent Law Reform, even if they contained nothing specially deserving of comment. It will be remembered that, in 1849, this subject was brought under the notice of the Society; and the result was, the issuing of a long series of questions, with the expectation of collecting information in the shape of replies thereto. The formation, therefore, of a Committee "to promote the legislative recognition of the rights of inventors" may be considered as the following out of a long predetermined policy; and it might reasonably be supposed, that the knowledge gained of the working of the patent laws by those members who took part in the former discussions, would have been made available in prosecuting this object of the Society. In glancing over the names of the Committee, however, we find that it is made up, with very few exceptions, of gentlemen whose connection with the Society could scarcely be counted by months; and, in some cases, weeks did not elapse between their election as members and their nomination to the Committee. This may be policy; but we confess we cannot understand it; for, where an honest desire exists to examine into the merits of a confessedly difficult subject, it would seem but rational to appoint tried men, or such as have proved themselves fit for the duty to be discharged; and that more especially where credit is to be lost or gained, according to the nature of the decisions that may be arrived at. But the logic of the Council of the Society of Arts appears to be of a more *recherché* order than that which appeals to common sense; and, therefore, the credit of the Society has been staked on the result of the deliberations of thirty gentlemen, who are, for the most part, strangers alike

to the subject under discussion and the *object* for which they have been induced to assume their present position.

It would be impossible to examine, analytically, a statement so rambling and incoherent as the Reports now before us; but we will attempt to shew what has been laid down as the "principles of jurisprudence which should regulate the recognition of the rights of inventors." The greater part of the first paper is devoted to criticising the present system of granting patents; but we may well be excused the duty of tracing the anomalies which exist in this branch of jurisprudence, as they have been most fully dwelt upon in these pages. The following is the summing up of this part of the subject:—

"All experience has proved, that it is hopeless to effect amendment of the present system of obtaining patents * * * *. Whilst the whole superstructure rests upon the fallacy that inventive rights are boons to be granted or withheld, and not rights of intellectual labor, it is idle to attempt to amend the details of the system. Public opinion and common sense pronounce the present forms empty pretences."

This being disposed of, the question of protection or no protection is entered into, and is thus argumentatively settled:—

"Every one must *feel* that inventive labor has its rights, which are not only entitled to equal recognition [to that of the stone-breaker on the road], but, being intellectual, are entitled, if possible, to a higher kind of recognition than other kinds of human labor. It may be called, for want of a more comprehensive phrase, a *natural* right, the exercise of which should be left perfectly free, and recognized as peculiarly sacred. To have, therefore, to *beg* for the right of enjoying it, is degrading, and is almost tantamount to an admission that you should *beg* to be allowed to live. It is altogether at variance with all the other rights which a member of the British commonwealth possesses at the present time."

If "every one must feel that inventive labor has its rights, which are entitled, if possible, to a higher kind of recognition than other kinds of human labor," why are we told that the policy of a civilized state to grant any rights to inventors is "still a question mooted by those *whose opinions demand respectful attention?*" Now, assuming this to be really the case—and it is an assertion which cannot be denied—surely some argument to prove the right of the inventor to a legal recognition of property in his discovery would have been more in place than an appeal to the feelings; and the conscious inability to substantiate this, the first and simplest position, by argument, should have acted as a check to further meddling

in the matter; for such incompetency could only arise from the want of a proper appreciation of the subject.

The inference drawn from the fact that the inventor possesses a "natural right" to the results of his mental labor, is thus laid down as the conclusion to the first Report, and is the only "principle of jurisprudence" therein enunciated:—

"It would thus appear, that it is simply the business of the State to provide an easy means of registration of claims, which the law should regard as valid, until they were proved to be otherwise, as is the case in almost every civilized country but our own; and the establishment of any tribunal to investigate claims, either before they are disputed or afterwards, appears altogether a separate and distinct question, quite independent of the policy of recognizing the rights of inventors to the fruits of their labor."

In their second Report, the Committee, after setting forth a string of resolutions, intended to form the heads of a bill, continue their analytical examination, in order to eliminate the principles of jurisprudence upon which this bill should be founded; and having already proved that "every one must feel that inventive labor has its rights," they proceed in the following strain, to shew upon what tenure these rights may be held:—

"It has been asked whether, like rights in land, in capital, and personal property, they should not be rights in perpetuity; or whether they should be limited in duration, like copyrights in art and literature? Without entering on this question, it appears to the Committee to be for the public good that rights in invention should not be perpetual. Inventions in science are based upon ideas and knowledge, which are the common property of the period, and they are the answer to wants previously uttered by the public. The discoveries of any one period could hardly have been made in any antecedent period, because they are the results of the condition of science and knowledge at the particular period brought to a practical result by minds specially directing themselves to it. It is right policy to reward the *first* successful discoverer, for that reason; but it would discourage invention if the rights of the first discoverer were perpetual, and in force against all others who might and would, independently of the first discoverer and his labors, have sooner or later arrived at the like result."

Here, however, is no demonstration of the injustice of granting a right in perpetuity to the inventor of any new manufacture; but there is still a begging of the question; and expediency, or the "public good," is set in the place of argument. There could be no objection to this course in dealing with all the points which arise on the discussion of patent law reform; but, having been induced by the tempting title of the

Reports, to look for "principles," in finding none we cannot but feel disappointment.

The following extract will shew the next point brought under consideration, and the mode of treating it:—

"If it be conceded that the rights of inventors ought not to be in perpetuity, it may be asked, What, then, should be their duration? What is the duration of analogous rights? In literature it is at least 42 years, and it may be longer. In sculpture and plastic art the original designer has rights for 14 years, and longer. In engravings, 42 years. In ornamental designs for manufactures it may vary from 9 months to 6 years. In designs for articles of utility, dependent on form or configuration, it is for 3 years. For those other classes of invention, which are the subject of letters patent, the duration is 14 years, and may be extended to 28 years. And as this period is already recognized, the Committee consider that 21 years should be adopted."

This decision of the Committee, that twenty-one years is the proper period for the duration of a patent, may have, and doubtless has been arrived at by a process of inferential reasoning; but we cannot, for our part, see why the one year, without the twenty, should not have been adopted on the same grounds, as that is also a "period already recognized."

But enough, we think, has been said, to shew that, for the eliciting of any truths which bear upon the rights of inventors, these Reports are utterly valueless. Let us now see what power is displayed in dealing with some objections to the pet schemes of the Committee, viz., the cheap protection of an invention by simple registration, without enquiry, or the possibility of enquiry. A chief objection to cheap patents is, that they would lead to endless litigation; but, say the Reports,—

"Direct experience has proved the contrary. The thousand registrations effected under the 'Utility' Designs Act have not encouraged litigation. Inventors oppressed by the patent laws have taken refuge under this act, and, as we have seen, have registered many inventions as being 'forms or configurations;' whereas it is notorious that the object of the claims is the protection of a new mechanical action or contrivance; and, besides the number of rights thus admitted, there has been the further incentive to litigation from the doubts which notoriously hang over such registrations. Still, irreconcilable as the Registration Act is perfectly well known to be with the common law of patents, and questionable as are many of the rights claimed under it, it has *not* been the source of increased litigation, but a much-improved tone of morals has been generated among inventors by its existence, who respect the registration, notwithstanding its illegality. It is thus proved, that if an inventor declares his right,

although the law does not strictly recognize it, it becomes respected. In this case the illegality of the registration is surely an additional motive for litigation and piracy; but there have been very few cases of infringement, and it is quite notorious that very little litigation has arisen out of the 'Utility' Registration Act."

Did it never occur to the Committee, that two parties are necessary to the carrying on of a law-suit; and that it is not the infringer of the alleged right, but the infringed, who usually commences the action; and, further, that the plaintiff seldom risks a suit without the prospect of getting a verdict; and that the known illegality of a registration is surely not a very strong motive for a registree to test the validity of his claims in a court of law? Yet such is the kind of argument by which the Society of Arts seeks to further the cause of patent law reform. Again, in answer to the objection, that a simple registration afforded no means of ascertaining which of two or more claimants was entitled to an invention for which protection was sought, and would, therefore, be highly detrimental to the inventive interest, we find the following remark, which, like the one last quoted, is also an appeal to "direct experience:"—

"If ever there seemed to be a likelihood of unconscious infringement, or an easy road to it, it is here [in cotton prints]: if ever a multitude of rights could create confusion and interruption to trade, it would be manifested in calico-printing. But the practical working of this act has been such, that there has not been an average of twenty convictions per annum during the creation of at least fifty thousand small rights. As for unconscious infringement of any one of them, such a thing is hardly possible; no two persons, however alike in taste and education, being set apart to devise a pattern on a given subject, would ever do precisely the same thing; *and it would be the same with inventions.* It is a law of nature that no two things can be precisely alike."

Could it have been supposed that any one, pretending to the least acquaintance with patents, would have asserted, that unconscious infringement of one of them was hardly possible? But yet we are gravely told that it is so. The best answer to this unfounded assertion of the Committee will be found in the evidence given by one of their own members before the Committee on the Privy Seal and Signet Offices. Mr. Woodcroft, under examination, is reported to have said,—

"In the year 1696, Thomas Savery, who is styled 'Gentleman,' and who is the person who was the first great improver of the steam-engine, took out a patent for improvements in navigation,

and published a work upon the subject, called 'Navigation Improved.' This invention for propelling, by Savery, was again patented in the year 1830 by a physician in this town, who, in ignorance of Savery's invention, obtained a patent for identically the same thing; and if I were to bring the Committee a list of all the patents that have ever been granted for improvements in navigation, I could find you, perhaps, two scores of patents granted for the same thing."

With such an evidence of incapacity on the part of the Committee, for leading the public to a correct appreciation of the subject of patent law reform, it seems inexplicable why the Council of the Society of Arts should have courted public censure by issuing these Reports. The question is undoubtedly a very important one, and well deserving the serious attention of any society of men desirous of promoting the prosperity of the country; but there are, as we believe, but two classes of persons who have any right to handle the subject in the public way in which it has been treated by the Committee of the Society of Arts,—namely, those who have suffered from the insufficiency of the laws to protect their interests, and those who, knowing the defects of the law, are conscious of the ability to suggest a remedy. Without, therefore, a practical knowledge of the question, or a personal experience of the defects of the existing system, we hold it presumption in any party to appeal to the public on the matter; and, as the thirty gentlemen of the Committee cannot, if their Reports are to evidence their ability, take shelter under either of these classes, we think their interference altogether uncalled for. To say that it has as yet been detrimental to the cause of patent law reform, would be, perhaps, to set too high a value on the arguments contained in their Reports; but all who have paid any attention to the science of agitation, must acknowledge that the constant iteration of the greatest balderdash will have its effect; and we do not apprehend that, while the many illustrious names which form the Committee remain available for endorsing fresh statements, the restless clique which now sways the destinies of the Society of Arts will fail to make the most of the opportunity. On the banner under which the Council of the Society of Arts now marshals its forces, it is easy to read the motto—"TO ACT IS NOBLER THAN TO THINK;" but it should be remembered by individual members who have the interest of the Society at heart, but yet shew a supineness as to the direction of its affairs, that although thought without action is nothing worth, yet action without thought is worth less than nothing. It behoves, therefore, the general body of members to look

closely to the future proceedings of the Patent Committee; for they have added enough to the hitherto sufficiently abundant evidence, that "ignorance seldom vaults into knowledge;" and it would be well if steps were taken to prevent these imbecile attempts at enlightening the legislature from being considered as embodying the opinions of the Society at large.

PROVISIONAL REGISTRATION OF INVENTIONS.

The demand (which originated, we believe, with the Local Commissioners for Liverpool) that protection should be granted to novel inventions offered for exhibition in Hyde Park, having been re-echoed from all parts of the country, has induced the government to attempt, for the second time, to effect this most desirable end. The signal defeat of the former bill, or of those parts of it relating to inventions, resulting, as it did, from a simple statement of the vast inconveniences which it was calculated to create, should have warned the government that an Act simply declaring that the exhibition (under certain restrictions) of unpatented inventions should not militate against their legal claim to novelty, was not sufficient to meet the cases; but, on perusing the draft of a bill recently presented to the House of Lords by Earl Granville, for the provisional registration of inventions (a copy of which is given below), we find it almost a repetition in substance of the bill of last sessions,—the only difference being, that the power of the Act is to cease with the occasion which called it forth. We would, therefore, in laying the bill before our readers, advise them not to found any hopes upon it; "for (to repeat what we formerly said) this class of Acts has hitherto been drawn by parties wholly unqualified for the task; and we fear that the present specimen will form no exception to the rule."

"Whereas it is expedient that such protection as hereinafter mentioned should be afforded to persons desirous of exhibiting new inventions in the Exhibition of the Works of Industry of all Nations in 1851: Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present parliament assembled, and by the authority of the same, as follows:—

I. The proprietor of any piece of workmanship, mechanical contrivance, or manufacture, being a new invention for the sole making, exercising, vending, or using whereof letters patent might lawfully be granted to him, may at any time during the year 1851, but not afterwards, publicly exhibit the same in any place previously certified by the Lords of the Committee of Privy

Council for Trade and Foreign Plantations to be a place of exhibition within the meaning of the Designs Act, 1850, without prejudice to the validity of any letters patent to be thereafter, during the term of the provisional registration hereinafter mentioned, granted for such invention to the proprietor thereof: Provided always, that such piece of workmanship, mechanical contrivance, or manufacture, have previously to such public exhibition thereof, been provisionally registered in manner hereinafter mentioned; and provided also, that the same be not otherwise publicly exhibited or used prior to the granting of any such letters patent as aforesaid.

II. The Registrar of Designs, acting under the Designs Act, 1850, upon application by or on behalf of the proprietor of any such piece of workmanship, mechanical contrivance, or manufacture, as aforesaid, and upon being furnished with such drawing or description thereof in writing as in the judgment of the Registrar is sufficient to identify the same, and in which shall be distinguished what part of such piece of workmanship, mechanical contrivance, or manufacture, is claimed by such proprietors to be a new invention, and upon being also furnished with the name and address of the person claiming to be the proprietor thereof, and with satisfactory evidence that such piece of workmanship, mechanical contrivance, or manufacture, is intended to be exhibited in such place of public exhibition as aforesaid, shall register the same for the term of one year; and any piece of workmanship, mechanical contrivance, or manufacture, so registered, shall be deemed to be provisionally registered; and the words "provisionally registered" shall be marked thereupon or attached thereto; and the said Registrar shall certify under his hand and seal of office that such piece of workmanship, mechanical contrivance, or manufacture, has been provisionally registered; and shall also certify the date of such registration, and the name and place of address of the registered proprietor.

III. Such provisional registration as aforesaid shall, during the term thereof, confer on the proprietor of such piece of workmanship, mechanical contrivance, or manufacture, with respect thereto, all the protection against piracy and other benefits which, by the Designs Act, 1850, are conferred upon the proprietors of designs provisionally registered thereunder with respect to such designs

IV. All letters patent to be thereafter, during the term of any such provisional registration, granted to the proprietor of any piece of workmanship, mechanical contrivance, or manufacture so provisionally registered in respect of such invention, shall, notwithstanding the registration thereof, and notwithstanding the exhibition thereof in such place of public exhibition as aforesaid, be of the same validity as if such piece of workmanship, mechanical contrivance, or manufacture, had no tbeen so registered or exhibited.

V. The protection and other benefits given by the said Designs

Act, 1850, and this Act, to the proprietors of designs and inventions provisionally registered, and exhibited in such place of public exhibition as aforesaid, shall extend to all proprietors whose designs or inventions shall be so exhibited as aforesaid, whether they be subjects of Her Majesty or not.

VI. All the provisions of the Designs Act, 1850, relating or applicable to the designs to be provisionally registered thereunder, or to the proprietors of such designs, except the provision for extending the term of any such provisional registration, shall apply to the pieces of workmanship, mechanical contrivances, and manufactures to be provisionally registered under this Act; and the said Designs Act and this Act shall be construed together as one Act."

ON THE ODIC PRINCIPLE OF REICHENBACH,

AND THE RELATION IT BEARS TO THE IMPONDERABLE BODIES OF IGNOTUS.

(Continued from page 132, Vol. XXXVIII.)

Having now endeavoured, in conformity with the views of Reichenbach, to shew *what od is not*, an attempt will be made, hypothetically, to consider *what it may be*.

That od possesses a degree of materiality, or, more properly speaking, ponderosity, is rendered probable by many of the experiments of Reichenbach; as, for instance, by its divergence from a rectilinear course when two streams, passing at an angle, are made to impinge on each other; by its capability of being more or less intercepted by various substances, as wool, &c. &c.; by its admitting of accumulation; and by its slowness of march as compared with magnetism or electric action. It may, therefore, be regarded as possessing some of the essential principles of ponderable matter, and, as such, more or less subject to the laws of chemical action,—in which sense it is intended to regard it. Differing from magnetine and electrine, it notwithstanding maintains more or less evident relation to both; and it is not impossible that it may be a peculiar compound, derived from their combination in certain equivalents. It has been assumed by Ignotus, that an especial combination of these elements gives rise to the matter oxygen, with those consequent effects or manifestations which are known by the name of electricity, or, more properly speaking, electric action. What the respective equivalents, to produce this particular combination, may be, it is vain at present to conjecture; but there is nothing at variance with the acknowledged laws of chemistry, in supposing that the given elements frequently, if not always, admit of union in different equivalents. This is conceived to be the case in the present instance; and that while *oxygen is a magnetide, the odic matter may be a per-magnetide of electrine.*

In pursuing this view, it will be necessary to detail more fully the nature or characters of electrine, magnetine, and the odic principle.

Electrine may be described as a *ponderable* chemical element, capable of entering into chemical union with other chemical elements, and as being an important constituent in their various compounds;—in the existing state of our temperature it is a subtle gaseous body, possessing more levity than any other of the known ponderable matters; it is impermeable to some few bodies, as glass,—by means of which it may be accumulated, as in the Leyden jar; but passes readily through the pores of most bodies: when influenced by its powerful affinity for magnetine as well as other matters, it is capable of moving with great velocity, so that its vibratory movements admit of giving rise to manifestations of luminosity;—in all cases where it enters into chemical combination, it becomes neutralized, and comparatively quiescent. These suppositions are apparently realised in that combination with magnetine which forms oxygen.

Magnetine, in its pure and free condition, is inferred to be a highly attenuated and subtle matter, evidencing, as far as experience goes, not the slightest ponderosity, and capable of penetrating and permeating with the greatest facility the pores of all ponderable bodies; in consequence, it pervades all matter,—the pores or interstices existing in which, may be said to be saturated with it. Magnetine possesses, among its other important properties, a powerful tendency to enter into chemical action; by virtue of which, it is capable of combining with all the various chemical elements, becoming then latent, and participating in their respective constitutions;—from such combinations, however, it admits of being again eliminated or disengaged in a free state when they are subjected to new chemical actions. These effects not only occur with respect to terrestrial but also celestial bodies, as in the solar orb,—the elimination and transmission of whose rays (assumed to consist chiefly of magnetine) are conceived to depend on the principle of chemical disengagement.

The above emanations of free magnetine, more or less rapid or energetic, in proportion to the violence of the chemical action by which they are disengaged, are materially connected with the principle of luminosity. In his original treatise, Ignotus was led to adopt the corpuscular theory of light, and regard it as an additional imponderable body, which he designated by the term *lumine* and supposed to be associated with the magnetine whenever luminous manifestations took place: subsequent reflection, however, has induced him to prefer the vibratory theory, and to consider *light* as always the result of vibratory motion,—the difference of color arising, like musical tones, from the given number of vibrations into which the luminous source may be thrown in a given space of time. This difference of opinion does not, however, affect or injure the general principles of his hypothesis, but, on the contrary, harmonizes better with it, particularly as applied to the explanation of electric, magnetic, or odic phenomena.

The assumption of the odic principle being a *per-magnetide of*

electrine, is admitted to be highly speculative; but probably none of the more subtle principles in nature will ever admit of any positive demonstration;—if, however, the hypothesis advanced, on investigation, indicates any capability of accounting for the facts which are manifest, and of obviating the difficulties or uncertainties with which they are surrounded, it ought to be deemed not wholly undeserving the attention of the pschycologist, and may prove useful in suggesting new channels of experimental enquiry.

That the presumed chemical combination with electrine, of additional equivalents of magnetine, would produce a compound *sui generis,* widely differing from electrine, oxygen, or magnetine, separately, or any other distinct combinations of them, is strictly conformable with the well known facts of chemical science. To particularize these differences, it may be conceived that electrine, containing in its constitution a relatively large proportion of ponderable principle, would not only be of greater specific gravity, but less mobile and penetrating, and more readily admit of accumulation; at the same time, from its strong affinity to combine with magnetine, it does not seem capable of remaining long or permanently accumulated, even within the interior of the Leyden jar. Similar reasoning applies to the magnetide of electrine or oxygen, with this difference,—that this compound possesses, not only greater apparent ponderosity than electrine, but is capable of assuming a permanent gaseous form; and is so dense as to allow collection by ordinary chemical apparatus.

When, however, the electrine combines with the magnetine in considerably fewer equivalents of the former, and relatively more numerous ones of the latter, so as to form the per-magnetide of electrine, or presumed odic principle, the ponderosity of the compound will necessarily be so far diminished, as almost, although not entirely, to justify us in ranking it amongst the imponderable bodies: at the same time, its tenuity is increased sufficiently to permit it to permeate, with more or less facility, the pores of all bodies, by which, from its affinity to their molecules, it can, as one of its peculiar properties, be attracted, and in a degree accumulated, in its passage through them. An additional consequence is, that the transit of the per-magnetide, as above, will be more or less tardy, according to the nature and constitution of the body it passes through;—in these respects conforming precisely with the character the Baron Von Reichenbach has assigned to his odic force. Another most important illustration is, that the per-magnetide of electrine in its movement, according to the greater or lesser number of vibrations into which it is thrown, gives rise to *luminosity* of various tints or colors, from the more languid blue to the more vivid red; possessing a degree of ponderosity, it also is susceptible of being deflected, like the solar ray, in its passage through the *prism.* In this way all the luminous phenomena, described by Von Reichenbach as belonging to od, may be explained.

It is now proposed to apply the above hypothesis in explanation of some other leading facts detailed by Von Reichenbach. In the first place, as respects the manifestation of od by the *magnet,* it may be observed, that we are by no means acquainted with the true nature of the fluid which circulates through that apparatus;—in fact, we cannot be sure whether it be pure magnetine, or is a compound matter which contains the latter in its constitution;—a remark which, in fact, admits of application to every known manifestation of magnetic principle observable in our system; even to those emanations which are derived from the solar orb. The deflection or refraction of the solar rays by the prism, indicates that they comprise more or less ponderable principle; and it is by no means improbable, that they may contain a small proportion of electrine, so as to be virtually a *hyper-magnetide* of the latter.

Ignotus assumes, that the solar rays result from a species of chemical action going on at the sun's surface, and analogous with terrestrial combustion; if this be true, it can scarcely be possible that the magnetine could be thrown off, entirely divested of electrine. It is, therefore, fair to infer, that the matter emanated (including that principle which circulates through the magnet) is not pure magnetine, but probably a hyper-magnetide of electrine, containing, it is true, very few atoms of the latter. If so, there yet remains a principle to be investigated, namely, *pure* magnetine, which may be presumed to be still more subtle and active than any hitherto treated of; but on the more intimate nature of which it would be vain to speculate. The mesmerist, however, might probably regard it as analogous with the mental principle, and as the cause of clairvoyance: in fact, according to the opinions of some of them, it would almost appear that the will, thought, or mind, may be transmitted from the brain in association with the odic principle, so as to become motive forces, operating externally to the brain from which they have proceeded!!

Assuming then the possibility that the magnetine emanating from the sun, as well as from all other bodies in nature, is not pure magnetine, but a combination of the latter with a portion, however small, of electrine, it will be desirable to enquire how such constitution will explain the differences found to exist between the magnetic and odic phenomena exhibited by the magnet; or how it is that od is always associated with the *magnetic* force; and also why the one invariably deflects the needle and attracts iron, while the other is entirely divested of these properties. According to more recent, but yet unpublished, opinions of Ignotus, the magnetic circulation of the ordinary artificial magnet depends on the operations of the great terrestrial magnet; which, receiving the magnetic matter at its northern or negative pole, passes it forward to the southern or positive one; from whence it is determined back to the northern pole along the earth's surface, forming a kind of vortical current: whenever this current, *in transitu,* meets with a ferruginous body, according to the pecu-

liar condition of the latter, it converts it into either a permanent or temporary magnet, capable not only of attracting iron, but, according to Reichenbach, of manifesting odic phenomena. The fluid thus circulating through the terrestrial or artificial magnet, Ignotus does not suppose to be derived directly or entirely from an emanation of magnetine from the sun, but partly by virtue of chemical action induced on the earth's surface by the impingement of the solar rays thereupon, which he conceives to have the effect of decomposing—with the co-operation of the terrestrial matters on which they fall—the oxygen existing at that surface, and, consequently, liberating its magnetine and electrine,—the latter principally passing off in an electric current from west to east, in conformity with the course of the earth's diurnal rotation in that direction; while the former darts off, at right angles, towards the negative pole of the terrestrial magnet, enters into conjunction with the magnetic current, and performs a most influential part in producing or keeping up the magnetic circulation.

In conformity with the views previously advanced, the magnetine liberated, as above, at the earth's surface, would necessarily be more or less impregnated with electrine; in which condition, as a per-magnetide of the latter, it is made to circulate through the magnetic apparatus, where—meeting with opposition from the peculiar arrangements of the tubular closed channel, assisted probably by an attractive or catalytic influence of the molecular particles of which that channel is composed—in consequence, a considerable portion of the per-magnetide of electrine, or the odic principle, is separated from the general mass; so that, while the latter passes off, in the general magnetic current, and in association with the ordinary magnetic force, the former, by virtue of its capability of penetration through the substance of all bodies, escapes through the sides of the magnetic channel, and odically charges the apparatus, whether it be terrestrial or artificial. In this way it may be conceived that the whole mass of our globe might, by the operation of the terrestrial magnet, in process of time, be charged with od, and become capable of emanating it again. The same principle might possibly be extended to the entire celestial system, which, according to Reichenbach, emanates od, and in which an analogous kind of magnetic circulation may be imagined to exist.

The distinction between od and the magnetism of Reichenbach, therefore, probably depends upon the circumstance that the former is a compound of magnetine and electrine, possessing properties peculiar to itself, and in which the quantity of the ponderable principle, electrine, is sufficient to render its movements comparatively slow or tardy; while the magnetic matter of the latter is of a purer and less ponderable nature, containing insufficient electrine to impede sensibly or essentially the energy of its motion; and which, in its transit through the closed channel of the apparatus, acquires that degree of momentum which enables it to accomplish the ordinary phenomena of the magnet.

Independently of any peculiar property it may possess, a sufficient reason why the odic force does not affect *iron* like magnetism, is, that as soon as it has escaped from the circulating stream of magnetism, it *is no longer under the influence of a closed apparatus*. This explanation will even apply to magnetism itself, so long as it is not moving in a closed current;—to the passage of magnetine from the sun, or through metallic bodies, iron alone excepted; or to its disengagement by chemical action; none of which shew any ordinary magnetic attraction, or, at least, any which is not of a temporary nature

It has been shewn above in what manner the whole of the universe may become charged with od, and be capable of again emanating it. This latter is doubtless affected by an exudation or passage of the odic fluid through the pores of the body emanating it, and differs in activity, &c., according to the peculiar constitutions of bodies in this respect. Od, in consequence, affects a polarity of its own. The polar arrangement of crystallized bodies appears to admit of the passage of od with great facility; it is not, improbable, however, that the principle of crystallic arrangement pervades all bodies; and to this may be attributed the polar circulation which Reichenbach applies to them universally. In fact, the whole of the varieties of od which he enumerates may be referred to this explanation.

There are two of Von Reichenbach's varieties, or sources of od, so interesting, that we will conclude the present paper with some observations respecting them. These are what he has designated by the terms *biod* and *manod,* or those manifestations of the odic principle which proceed from *living beings,* and which evidence some important, if not peculiar phenomena; in fact, the vital functions appear intimately associated with them. The odic principles applicable to them are apparently regarded by the Baron as results of chemical action undergone in the processes of digestion, chylification, and respiration (p. 174). Ignotus, however, pursuing a similar series of causes, has extended the matter farther, and referred the production of vital phenomena, particularly as applies to animal life, to the agency of magnetine, eliminated, by virtue of catalytic action, from the arterial blood conveyed to the brain. In this opinion he is still inclined to persist, modifying it, however, in conformity with his more recent considerations of the odic principle. He now conceives, that the material secreted and accumulated by the brain, which serves to produce the vital functions, may be *per-magnetide of electrine,* the source of which will easily be rendered obvious,—namely, that the arterial blood, the material from which he supposes the nervous power or vital principle to be secreted, is not merely rendered, as he formerly conceived, *per-magnetenic* by the process of sanguification in the lungs, but combines with it a sufficient portion of electrine, derived from the oxygen respired, to form per-magnetide of electrine; it is therefore charged with the odic principle, which then becomes the support of the vital actions

This odic or vital principle, if emanated *per se* from any part of the body, with or without the co-operation of the will, might be expected to manifest itself by ordinary odic phenomena, in conformity with the opinions of Reichenbach; and, according to the views of the mesmerists, would constitute the basis of animal magnetism. That the brain has the power of purifying this odic principle, or per-magnetide of electrine, so as to convert it into magnetine, and render it the agent in producing mental power, Ignotus does not believe; the supposition would, in his opinion, verge into gross materialism: on the contrary, he regards *mind* as a superadded spiritual principle, derived immediately from the Divine Creator, in whose proper essence it, however slightly, participates, and which, like Himself, is unalterable and eternal.

P.

INSTITUTION OF CIVIL ENGINEERS.

February 4th, 1851.

WILLIAM CUBITT, Esq., President,—in the Chair.

The paper read was, *An enquiry into the nature of patent law protection, with a view to the better appreciation and security of the rights of inventors*,—by Mr. A. V. Newton.

The object being rather to elicit facts, with a view to forming a basis for some legislative amelioration of the patent laws than to detail the anomalies and inconveniences of the present system, the paper only touched on such points of the practice of granting patents as were conceived to be bad in principle, and but slightly touched on the cumbrous and antiquated machinery employed in effecting these grants.

The policy of granting any patents was discussed, with the view of meeting the objections raised against the issuing of these privileges; and, in considering this point, it was found necessary to examine the relation of inventions to other creations of the mind, —as literary and artistic productions, whose right to protection had been universally admitted. It was argued, that a literary composition, a picture, a statue, a decoration, or an invention, resulted from the exercise of the inventive faculty; and that all or none of these results were entitled to protection. The Copyright Acts had secured to the literary man, the artist, and the designer, the benefits resulting from their mental labours; and the claims of the inventor being based on similar grounds, protection could not in justice be denied him.

The claim which the inventor has upon the public was next considered. The oft repeated experience, that an important improvement in the useful arts has emanated from independent sources, would go to prove that no useful invention would have been lost to the world if it had not been received from the hands of its first discoverer. The merit, therefore, of the inventor ap-

peared to be the *forestalling of time*, by realizing some fact in physical science before the ever-increasing common stock of knowledge had put it in the power of the ordinary observer to seize upon and apply it. From this it was inferred, that a limited interest in the pecuniary benefits derivable from his discovery was all that the inventor was, by right, entitled to; and that before he was entitled to a legal recognition of his right—the reward of merit—he must shew the world wherein, and to what extent, he has excelled his fellows: this he is supposed to do when he applies for a patent; and at such time the date of protection should commence.

As regarded the party to whom protection should be granted, supposing that several applications were simultaneously made for a patent for the same invention, it was held, that the first applicant for a patent, in the absence of all fraud or collusion, should have the grant made to him; but that no claim should be entertained without the setting forth of the real inventor's name in the title.

The Act of James I., as to the definition of what was a patentable invention, was examined, and was shewn to be satisfactory; and that its very vagueness constituted its great merit.

As regarded the cost of patents, evidence was quoted to shew, that the maintenance of the present fees were advocated on the presumption of their being a sort of check to the patenting of useless inventions; and this they were shewn not to have effected, but rather to have acted as a bar to the introduction of useful improvements. This was proved by statistical facts, shewing the number of inventions patented in foreign countries, from which Great Britain derived no benefit.

The disadvantages arising from the necessity of obtaining distinct patents for the three kingdoms were strongly insisted on; and the impossibility of satisfactorily establishing an international patent right was clearly proved.

With respect to the duration of patent grants, it was shewn that, if the term of the grant was sufficient to induce inventors to bring forward their discoveries, the desired object of granting patents was obtained; and the burden of proof of the insufficiency of the term of fourteen years devolved on those who advocated a further extension.

From this enquiry it was concluded—

That the rights of inventors to the fruits of their labors were based on the same grounds as those of artists and literary men.

That an inventor had no moral right to more than a limited interest in his discovery.

That the proper period for the recognition of an inventor's rights was when he applied for a patent.

That priority of invention should not of necessity confer a legal right to a patent; but that it was to the inventor (supposing there to be more than one) who first claimed a patent, that the privilege should be granted.

That the definition in the Act of James I., of what was a patentable invention, was amply sufficient, and therefore required no amendment.

That the present tax on patents had proved a serious check to the development of invention, without conferring any corresponding advantage.

That the recognition of the rights of inventors in Great Britain, by the grant of three distinct patents, tended to narrow the application of their ingenuity to one division of the United Kingdom.

That inventions should be protected by one grant in the United Kingdom; and that any attempt at international arrangement would be impracticable.

That the existing term of patents required no extension.

And that patents should not be renewable at the option of the patentee.

The discussion on this paper was commenced, and adjourned until the next meeting.

A model of a self-acting siding stop for railways, designed by Mr. Charles Hutton Gregory, M. Inst. C. E., was exhibited and explained.

The stop consisted of a block of wood shod with iron, and either turning or falling across the rail. A counter-weight retained it when down in the iron chairs on each side of the rail; and, being connected with the switch by a wire-rope and two bell-cranks, both must be moved simultaneously. When the switch was set for the main line, the counter-weight kept the stop on the rail, and closed the siding; but when the switch was set for the siding, the weight was drawn up, and the block turned over, so as to leave the rail clear; thus leaving the siding uninterrupted. It was explained that, by the same arrangement, a block might be made to move sideways, or to slide transversely across the rail. The use of this stop involved no extra labor, as it was worked simultaneously with the switch; it was very cheap and simple in its construction, not costing more than £3, and was not liable to derangement. It had been made for the Bristol and Exeter Railway, by Mr. Hennett, of Bridgewater, and was found to act well in practice.

February 11th and 18th.

The discussion on Mr. A. V. Newton's paper was renewed, and was continued throughout both evenings.

An appendix to the paper was read, in which it was submitted that, if the conclusions drawn by the author were correct, the spirit of the existing patent law (considering the Act of James I. as such) should remain intact; and that the aim of patent law reformers should be directed to matters of detail. It was urged that, by the passing of any measure that would disturb the system of judicature, as laid down in the leading decisions of the judges, the battle of the inventor, as against the public, would have to be

fought again and again, until the new ground which the two parties had taken came to be thoroughly understood. As the result of his enquiry into "the nature of patent law protection, with a view to the better appreciation and security of the Rights of Inventors," the author submitted—

That the patent laws, as at present interpreted and administered, were based upon the spirit of justice; and that any alteration therein, tending to set aside the *dicta* of the judges, would be in the highest degree detrimental to the inventor's interest. And further, that all suggestions for the amelioration of the patent laws, to be judicious and beneficial to inventors, must refer solely to the granting of patents, and in no way touch upon the validity of patents when granted.

In the discussion, the subject was first examined legally; and whilst it was admitted that the present patent laws were capable of improvement, it was urged, that the question should be very carefully argued, under all possible contingencies, and the bearings of every position be well considered, before any innovations were introduced, as the most disastrous consequences would result from any proceeding which increased the number of useless patents, and interfered with the manufacturers.

It was argued that, in one respect, the analogy between the copyright of a book, a picture, or a design, and the protection granted for an invention, would not hold; and that, therefore, these several properties could not be submitted to the same rules. The existing facilities for offering opposition to the demands for patents were considered to be productive of benefit; for many applications had been successfully contested, which, if they had been granted, would have materially interfered with the public interest.

The present high cost of patents was deemed injudicious, as having, among other objectionable effects, the tendency to induce the introduction of several distinct inventions under the same title, in order to save expense; and thus the system almost offered a premium for litigation.

The mere registration of inventions was then contended for, in order to reduce the cost, and avoid the tediousness of the present system.

To this it was replied, that it was sufficiently difficult now for a patent agent to advise a client as to the novelty of an invention; but that if cheap registration was adopted, it would become impossible for any man, devoting his whole time to reading, to make himself acquainted with all that he should know, in order to perform the duty of protecting his client's interest.

As to the cost of patents, it was urged that cheap patents would render necessary cheap law, to defend the rights of inventors, as all profitable patents were certain to be infringed.

It was contended, in opposition to a statement in Mr. Newton's paper, that the fact of so large a per-centage of the patents applied for never reaching the last stage, could not be attributed

to the expense of the different stages, so much as to the discovery that the inventions to which these applications referred really possessed no intrinsic merit, and that it was only common sense to abandon them.

It was asserted, that there was always more available capital at command for working patents than there were good and useful inventions to be brought into general use. Their registration was again objected to, on the ground that, in drawing up the specification, the legal adviser frequently brought prominently forward some important feature of an invention which had not been considered of any moment by the author, and whose interests would probably have materially suffered if that point had been neglected.

The appointment of a Registrar or Board, to revise specifications, was objected to, as a most destructive measure; and it was asserted, that juries very rarely decided contrary to the justice and common sense of a case. That the finding of a jury had scarcely ever been reversed in a court of law; whilst the ruling of judges had frequently been admitted by themselves to be erroneous. The examination into patent questions by a jury composed of men engaged in pursuits analogous to the subject of the invention, would be dangerous, as bringing self-interest to bear against probity.

With respect to the practical operation of patents on mechanical improvements, it was shewn that several important inventions had never been made the subjects of patents at all, and that they had remained unused for terms of years before the public had appreciated them. The planing-machine and the key-groove engine were examples of this position.

With respect to the assumed number of useless patents, it was asserted, that there was no instance of any machine whose perfection had been hindered by the difficulty of bringing into accordance numerous patents taken for the several component parts of the machine. Every successive patent might be for a progressive step necessary for the eventual combination of a perfect machine. This was demonstrated by recent cases of litigation on patent cases.

It was proposed that patents should be granted for a limited term, subject to a succession of renewals, up to a certain period, by the payment of a gradually increasing tax, which would cause useless patents to lapse, and would enable the ingenious poor inventor, to obtain the due reward for the exercise of his talents, without his resigning to the capitalist the greater portion of the profit.

Although no definite result was arrived at, the general opinion appeared to be, that the present cost of patents might be considerably reduced; the forms of procedure much simplified; and, by rendering compulsory the depositing of the specification at the time of applying for the patent, effective protection would be afforded to inventors.

INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

J. E. Mc CONNELL, Esq , Vice-President,—in the Chair.

January 22nd, 1851.

After the reading of a congratulatory address from the Council, on the prospects of the Institution, and the transaction of certain routine business, the following supplementary paper, by Mr. W. A. Adams, of Birmingham, was read :—*On the improvement of the construction of railway carrying stock.*

In the paper laid before the last meeting of the Institution, the great increase that has gradually been made in the dead weight of railway carrying stock was pointed out;—the first-class carriages, carrying 18 passengers, having been increased, in dead weight, from 3¼ tons to 5 tons; and the waggons, carrying a maximum load of 5 tons, having reached a dead weight of 4¾ tons; whereby an important addition was simultaneously made to the cost of locomotive power for the nett load carried.

The great increase in dead weight has arisen from the gradual increase in the quantity and weight of material employed in the construction of railway carriages and waggons, as a remedy for the failure of their different parts; and that without alteration of material or the construction of parts. The reduction of the dead weight of railway vehicles is extremely desirable, while such reduction of weight is effected with due regard to efficiency and strength to resist the longitudinal strain in buffing, as well as the other strains to which they are subjected. The object is to produce such vehicles as shall be, all points considered, the most economical in first cost, in maintenance, and especially in traction; but it does not follow that reducing the dead weight, and improving the quality of the materials, will add materially, if any, to the cost.

The *sole-bar* is the most important part of the waggon underframe, as it resists the main force to which the waggon is subjected, namely, the longitudinal buffing, and also acts as a girder to carry the load upon the springs. The ordinary wood sole-bar averages from 10 to 12 inches deep, and 3½ to 5 inches thick. Although the principal strain is the end-way buffing, the vertical strength is required to be so much greater than the lateral strength, in consequence of the sole-bar being strutted horizontally by the internal framing.

The author has endeavoured to discover the best form to attain the same strength in wrought-iron with the least material, and thereby ascertain whether the same strength can be attained with less weight than the ordinary wood sole-bar.

The average dimensions of the ordinary English oak sole-bar are 11 inches deep, 4½ inches thick, and 13 feet long,—the total weight, in actual practice, is 321 lbs. The correct theoretical section for wrought-iron, to answer the same purpose with the least

material, would appear to be a box-girder, of similar shape to the oak sole-bar. But this cannot be practically adopted, as it would be next to impossible to manufacture; and it is necessary that some practical form of rolled-iron be adopted, for economy and simplicity of construction. The main force to be resisted is the end-way buffing; and, as the strongest form to resist end pressure with the least material would be a tube, (as shewn by dots in Plate IX., at fig. 1,) that section which imitates a tube the nearest will be the correct form. The strength of the tube arises from the metal being distributed at the greatest distance from the centre: therefore, in the section, fig. 1, the metal has been principally distributed in three points of the circumference of the circle, which points are connected by the thin sides of the iron. But, inasmuch as the vertical strength is required to be considerably greater than the lateral strength, this theoretical section requires altering to the proportion shewn at fig. 2. The practical section proposed to be adopted on this principle is shewn at fig. 3,—the height being 7 inches, and the width 4 inches; the sides being as thin as practicable; and the metal being thrown into the extremities. The thickness of the sides is, therefore, $\frac{5}{16}$ inch, and the extremities $\frac{3}{4}$ inch. The weight of this section (13 feet in length), is 219 lbs., being nearly one-third less than the ordinary oak sole-bar, which weighs 321 lbs.

The following experiments were tried, to ascertain the requisite strength of iron to be employed for this purpose.

An English oak sole-bar, 10 feet long, of the common sectional form, of picked quality, and straight-grained, was subjected to end-way pressure in a hydraulic press,—being supported only at the two ends.

15 tons,	deflected it		$\frac{3}{8}$	inch at the centre.	
$22\frac{1}{2}$	,,	,,	$\frac{1}{2}$	,,	,,
30	,,	,,	$\frac{5}{8}$	,,	,,
35	,,	,,		when it broke.	

The breaking did not appear to be caused by deflection, but by the crushing and lateral separation of the fibres;—the principal fracture being several feet in length, and extending from side to side on the edgeway of the timber.

A wrought-iron bar, of the Great Western section, shewn at fig. 4, and the same length (10 feet), was fixed in the press in the same manner.

15 tons, deflection none.
19 tons deflected it $\frac{1}{4}$ inch, without set.
$22\frac{1}{2}$,, ,, 4 inches, permanent set $2\frac{3}{4}$ in.

The deflection was entirely lateral, and towards the side of the larger flange. This bar is made of two pieces, rivetted together, one 7 inches high and $\frac{1}{2}$ inch thick, with a small flange on one side, and an angle iron, 3 inches wide, is rivetted to it on the opposite side.

To ascertain the comparative vertical strength, an English oak

sole-bar was placed edgeways on two supports, 6 feet apart, and the force of the press applied in the centre.

10 tons deflected it $\frac{1}{2}$ inch.
12 „ „ $\frac{5}{8}$ inch.
16 „ „ broke it.

The wrought-iron bar of fig. 4, section, was tried in the same manner, with the force applied on the edge, and supported on the flange.

10 tons deflected it $\frac{1}{4}$ inch.
12 „ „ $\frac{5}{8}$ „ permanent set $\frac{3}{8}$ inch.

From the results of these experiments, it appears that the iron bar, fig. 4, is about as strong as the wood sole-bar, to resist vertical force, but is somewhat deficient in strength to resist the endway buffing. In this section a loss of strength is caused by its being made in two pieces rivetted together: the deficiency is in lateral stiffness, which would be considerably increased if it were all one solid bar of iron. It appears from the following experiment that the deflection would be on the *opposite side* to the large flange, if the whole were solid.

A bar $7\frac{1}{2}$ feet long, of the section, fig. 5, was subjected to endway pressure in the same manner as before: the depth was 6 inches, the width $3\frac{1}{2}$ inches, and thickness $\frac{5}{8}$ inch.

23 tons produced no permanent set.
26 tons produced a permanent set of $1\frac{3}{4}$ inch laterally, and $1\frac{1}{4}$ inch vertically,

the deflection being on the *opposite side* to the flange.

Also a bar, $5\frac{1}{2}$ feet long, of the section, fig. 6, was tried in the same manner by end pressure: the depth and width were both 3 inches, and the thickness $\frac{3}{8}$ inch.

9 tons produced a permanent set of 1 inch, both laterally and vertically the same,

the deflection being in the *opposite direction* to the flanges, and diagonally, as shewn by the arrow, from the depth and width being equal.

From these results, it appears that the two edges of the bar yielded to the pressure more than the rest of the section, and allowed the bar to bend outwards. These edges are consequently strengthened in the proposed section, fig. 3, by increasing the thickness, which will diminish the deflection, and enable the bar to resist a greater endway strain without permanent set.

An important circumstance in the comparison of strength between wrought-iron and wood is, that with iron the full experimental strength is obtained in practice, but in wood the strength obtained in practice is considerably less than that shewn by experiment, on account of the defects to which timber is liable and the mortices and bolt-holes cut into it.

The author stated that he was about to have a quantity of iron rolled to the proposed section, fig. 3, for the purpose of constructing certain waggons, and hoped to be enabled, previous to the next meeting, to give the results of actual trial.

A very important advantage would be obtained by the use of iron from its greater durability. English oak, admitted to be the best material, cannot be procured in a thoroughly-seasoned state in any large quantities, and is consequently, after it is made up, in a transition state for a term of years. The timber opens and shrinks, and the joints loosen, admitting wet and accelerating decay.

But, presuming that an efficient waggon frame be practicable from iron, it is difficult to place a limit upon the period of its duration, if well preserved from oxidation by paint or tar.

It should be noted that the English oak, weighing 72 lbs. per cubic foot, is in the unseasoned state in which it is generally used for waggons; and that as it seasons in work it lessens considerably in weight, but at the same time loses in strength.

The author had not been enabled to carry out his investigation into the application of iron to railway vehicles, further than as respects the principal portions of the underframe, but proposes to continue the subject practically before the next meeting.

Mr. T. Thorneycroft observed, that he had witnessed some of the experiments that were described in Mr. Adams' paper, and could testify to the accuracy with which they were performed.

It was suggested that it would be difficult to roll a bar of iron of the proposed section, fig. 3; and a proposition was made that it should be rolled with the ends flattened out a little, and that they should be closed in at the last time of passing through the rolls.

Mr. Slate remarked, that the author's deductions appeared to lead him to the conclusion that the hollow rectangular section was the best form, provided the iron could be rolled into that shape; but he diverged into the L-form, because it was the only practicable shape. He thought there would be no difficulty about rolling the rectangular section, but there would be some difficulty about the other; if it were sufficient for the purpose of fixing the cross framing, it could be rolled out as easily as a tube, and, with the aid of another mandril, might be flattened into any rectangular shape desired, which would probably be less expensive than rolling the L section.

Mr. Cowper remarked, that the cost of rolling the proposed L section, fig, 3, might not be more than £2 per ton extra upon bar iron.

Mr. Allan inquired how the Great Western plan was found to answer; for they had some hundred waggons running, made with the frame of the section, fig. 4.

Mr. Barrans suggested the adoption of the rectangular section, with wood blocks filled in where required, and bolted through to give strength to the frame. He asked if it could not be rolled in two parts and rivetted together afterwards.

Mr. Adams replied, that would bring them to an increase in cost per ton, and the expense was an important matter to be taken

into consideration. It was desirable to get a square side and bottom for attaching the spring-shoes, with the cross-bearers merely rivetted through; and he thought a mitre-joint at the corners of the frame would be necessary, and that the proposed L section was the most convenient for all these purposes.

Mr. Wright said that, in considering the increase in weight of railway-carriages, it must be borne in mind that the public had demanded increase of strength and room, as essential to comfort and security, more especially in rapid travelling. He thought the comparison between the common road-coach and the railway-carriage would not hold; because not only did they go at a very limited speed, but they were provided by contractors, who, for the sake of their horses, had the vehicles as light as possible; and it must be remembered there was no danger arising from collisions;—there was no buffing, but only traction. The uniform requirement of the public had been for an increase of strength in the railway plant; and they had abundant proof that the original carriages with open frames had not been strong enough to bear concussion; for, in collisions, such carriages received all the damage; whilst the modern strong-built carriages escaped uninjured. According to the views of the writer of the paper, in increasing the weight of carriages, as a necessary consequence of increased size and strength, they had been going back instead of forward; but he was not of that opinion; on the contrary, he thought they were decidedly improving in construction. He could not imagine that the iron sole-bar proposed would be so strong as the wood; and he thought good seasoned oak-timber would be found preferable for the purpose.

Mr. Adams observed, that the original carriages had not been found strong enough for the duties they had to perform; but he considered that, in increasing their strength, the dead weight had been too much increased, from the want of scientific principles in the construction.

Mr. Cowper remarked, that the observations of the paper were directed to find out the best kind of frame, and to discover the mode of making a good frame as light as possible, consistent with strength and durability. He thought that the proposed section promised a good result; and he could speak practically on the subject, because he had made a great number of experiments on the end thrust of L and T-iron for iron roofs: he had found that, when the edges of the flange were thin, the iron was defective in strength to resist an endway thrust. The metal at a distance from the general centre of the section was most advantageously placed for strength; and in the section, fig 3, the metal was distributed as far as possible from the centre,—thereby securing the full advantages obtained by the depth.

Mr. Slate conceived it a matter of the highest importance to diminish dead weight; and that great improvements had yet to be effected in that particular;—certainly, if they had now 5 tons of dead weight where they had formerly 3¼ tons, they had not

much improved; for they had thereby increased the cost of traction one-half. He did not know of any instance where there was so large a proportion of dead weight in any kind of machinery as there was in railway rolling stock; and the dividends on railway property must be diminished by it. It was surprising that, on a road possessing such perfection and advantages, they should have such an enormous proportion of dead weight;—in an abstract sense, it rendered the new railways less perfect than the old roads, where the proportion of dead weight was so much less.

Mr. Wright thought it ought to be observed, that railway-carriages had been much increased in their size, to suit the convenience and comfort of travellers. Originally, they were 15 feet long, 6 feet 6 inches wide, and 4 feet 9 inches high; but now they were from 18 to 20 feet in length, 7 feet wide, and 5 feet 6 inches high. The increase in size was of course one element in the increase of weight. Originally, in the case of the axle-journals, they were $4\frac{1}{2}$ by $2\frac{3}{16}$ inches; but they had soon increased to 5 by $2\frac{5}{8}$ inches, and were now much larger;—also, the wheels were originally 17 cwt.; but now they weighed from 25 cwt. to 27 cwt. These had to do the same business;—the number of passengers were not increased, but the vehicles to carry them were heavier.

Mr. Henson was of opinion that, before long, the dead weight would be reduced one-third, while the weight carried was increased one-third; and that the cost would be also diminished. He was engaged in the consideration of the subject, and would be glad to bring the results before the Institution at a future meeting.

The thanks of the meeting having been voted to Mr. Adams, for his communication, the following paper, by Mr. Parkinson, of London, was then read:—

On a water-meter.

There may be considered to be two descriptions of water-meters, as is the case with gas-meters; one in which the meter is turned by the pressure arising from the elevated source of the supply, and the other by the gravity or weight of the water; in other words, one working under pressure and the other not. Perhaps the first water-meter ever constructed was similar to a steam-engine, with cylinder, piston, crank, &c. This description of meter is worked by pressure, and the water will rise beyond the meter to any elevation short of that by which it is moved, save the friction of the meter. The one moved by the weight or gravity of the water will not allow the water to rise above the point of discharge: it is therefore indispensable that this meter should be placed above the point where the highest supply is required; and if this should be in the highest room in a house, the meter must be placed a little above; and, of course, every room below will be easily supplied by the gravity of the water.

Many modifications of these two plans have been made from time to time.

The chief objection to the high-pressure principle is the difficulty of making the machines perfectly water-tight, easy to move, and of cheap construction, to bear the varieties of pressure and speed to which they may be subjected; and another obstacle is the non-elasticity of the water preventing the uniform working, by locking the machine, if the valves or flaps open or shut too soon. The chief objection to the meters on the gravity principle is, the difficulty of any float opening a valve or stop-cock at the proper times, to define the proper measurement of the water.

Looking carefully over all these plans, the writer found none so well adapted as the gas-meter: it is as simple as a grindstone, and turns with the least possible weight of water. The velocity is maintained at a rate as nearly uniform as possible, by means of the regulating valve, and will pass the quantities denoted on the badges, with a pressure of water varying from 2 feet to 400 feet.

In Plate IX., fig. 7, is a front view of the meter, shewing the regulating valve; and fig. 8, is a transverse section of the meter. *a*, is the inlet-valve in the supply-pipe, which is opened by the ball-cock *b*, when the water is lowered in the small cistern *c*, from which the water is supplied for use over the building. *d*, is the regulating valve, for maintaining a uniform level of water in the meter; it is opened by the float *e*, and is constructed with a piston *f*, upon the valve-spindle, of the same area as the valve, which balances the pressure on the valve, so that it is not affected by the pressure of the water in the supply-pipe, and is easily opened or shut by the float *e*, however great that pressure may be. The guard-plates *g*, check the force of the water passing the valve, and prevent the water in the meter from being agitated.

The drum *h*, is similar to that of a gas-meter with four compartments, formed by oblique radiating plates, which overlap each other nearly half round the drum; and each of the compartments opens into the outer space *i*, of the drum, into which the water is poured, and from which the water enters each compartment in succession. The water escapes on the opposite side of the drum into the trough *k*, and, in passing through the drum, turns it round, as the oblique position of the divisions removes the outlet-opening of each compartment nearly half a revolution from its inlet. The drum revolves freely in the trough *k*, and the water flows through it with very slight resistance, registering itself by the revolution of the drum as it passes through, and then overflows the side of the trough *k*, and passes into the supply-cistern *c*. The spindle of the drum moves wheelwork by the worm *l*, like a gas-meter, to register the number of gallons on a dial. The trough *k*, is suspended by the hoop *m*, with an adjusting-screw *n*, at the top; by means of which, it can be raised or lowered, so as to adjust the meter accurately in measurement: as the quantity of water that the drum measures in each revolution depends upon

the depth of its immersion in the trough, the deeper it is immersed the more water it takes to turn it round, and *vice versâ.*

The velocity of the meter should be kept tolerably uniform; as the trough which holds the water will vary slightly, according to the quantity supplied to it. This is but a trifle, as the overflow is all round the trough; and therefore the meter is made to measure the water correctly when going rather below its full speed; so that, when used at full speed, it will give a trifle over, but less than one per cent., in favor of the consumer.

Mr. Clift observed, that he had carefully tested this meter, and found that it measured liquids very accurately; and, indeed, small quantities were measured by it more accurately than could be effected by pouring from one vessel into another. It was a very ingenious contrivance; for the valve took off the pressure, and allowed the meter to work with a heavy pressure exactly the same as with a small pressure. Meters had heretofore been made to work under pressure; but it became impracticable to use them for common purposes, in consequence of their great expense, caused by the strength necessary to stand the heavy pressure. This meter was placed at the top of the building, and registered the water that passed down to supply the house; the cistern below was always kept full, and not more than full, in consequence of the float-valve, which stopped off the supply when the water was not being used. He had been informed by Mr. Parkinson (who was unable to attend the present meeting), that he had so many applications for these meters from different Water Works Companies, that he could not supply them fast enough. The Sanitary Commissioners had recommended the employment of meters for the supply of water to all small houses in large towns, as the small consumers were at present supplied at a higher rate than others; and it was probable that some meter would ultimately be adopted by all Water Companies.

The Chairman thought it very likely that this plan of measuring water would be very useful; and a meter was much wanted, particularly by those who purchase large quantities of water, as Railway Companies,—the only means of ascertaining the quantity consumed being by measuring it into tanks.

SOCIETY OF ARTS.

HENRY THOS. HOPE, Esq., M.P., Vice-President,—in the Chair.

January 15th, 1851.

Mr. Henry Cole read a Report from the Council on the policy intended to be pursued in the conduct of the Society during the present Session.

In the absence of Mr. Henderson, who was prevented from

reading his promised paper on the Statistics of the Material and Labour employed in the Building for the Great Exhibition, Mr. Fox attended the meeting, and expressed his willingness to answer any questions as to the details of construction, &c., of the edifice.

The following remarks were then elicited from Mr. Fox:—He believed the building would be one of the dryest ever constructed, as it would always be acting on the principle of a still. Any exhalation that might arise from the soil would naturally rise till it came in contact with the glass at the top, where it would be condensed, and must trickle down by capillary attraction, and find its way to the small groove on each side of the Paxton gutters, and be eventually carried into the sewer; so that evaporation would never have the power of returning, because the moment condensation took place, the moisture would escape through the gutters. The grooves not only took away the condensed water, but, supposing a pane not to be sufficiently tight in the roof, any small quantity of water that might escape through the edge of the glass, and get underneath, would find its way to the groove and thence pass away. The transept roof and the skylight bars were what was commonly called "herring-boned;" in fact, they were angular, both horizontally and vertically at the same time. So that in the transept roof, from top to bottom, the same principle of capillary action was at work and provided for; and every skylight was arranged on a slope of two and a half to one, which is the same as in the horizontal roof.

Respecting the capacity of the building to withstand the effects of the wind, Mr. Fox remarked, that the building rested on 1060 columns, and the most likely direction for the wind to have any injurious effect on the building must of course be that of its greatest width, which was 1800 feet, as compared with 400 in the opposite direction. These columns rested on cast-iron plates, based upon concrete; and they could not rock about without the base plates being broken. Above these plates were sleepers, to carry the floor; they were 13 inches in depth, fitted accurately between the columns, and running transversely from one side of the building to the other; so that not one of these columns could possibly be upset until it was actually broken in two. Again, at the top, the columns are united by cast-iron girders, three feet deep, and four columns are framed together very much as a table is framed. Now, to break the column, they must exert a force equal to that of twice its transverse strength. From experiment, it was found that twelve tons was the breaking weight of the columns in the centre. Now, 1060 columns multiplied by six tons (half the breaking weight) was equal to 6360 tons; so that it would be necessary to exert a force equal to 6360 tons, at a height of 24 feet from the ground, before the building could be blown down—without taking any bracing into account. Taking 28 lbs. on the square foot as the force of the wind, and assuming a gust of wind which would strike the whole side of the building at the same moment, the total force would be from 1400 to 1500

tons. Now they had got a power to resist it of 6360 tons,—not taking into account the bracings, nor the offices and other constructions within the building, and which must, of course, add to its strength. The late gale, when Colonel Reid ascertained the force of the wind to be 19½ lbs., did no harm whatever, at a time when the roof was not on, and the building was quite exposed.

The effects of contraction or expansion due to atmospheric changes had been taken into account and fully provided for. In relation to this point, Mr. Fox said that the length of the building, from centre to centre at each end, was 1840 feet, and the width of its general rectangle 408 feet. The total difference in length of a cast-iron bar 408 feet long, between the extremes of summer and winter, would be about 1⅛ inch. The building was divided into two by the nave,—the only connection between the two sides being the wrought-iron trusses and the roof. The greatest difference which could by any possibility take place in the perpendicularity of the columns, from the effects of a change in the atmosphere, would be about a quarter of an inch, while it would be perfectly safe to bend any of them to the extent of two inches. In order to provide for stiffness, they had determined that, in the lengthway of the building, the expansion and contraction should be entirely provided for by the elasticity of the columns themselves, which were all "keyed up" hard and fast together for distances of 200 feet at each end, and for a similar distance on each side of the transept. The girders would have the opportunity of sliding upon the brackets which supported them. The flooring of the galleries, running the whole length of the building, served, with the Paxton gutters, as a continuous wooden tie, leaving the cast-iron in a condition to move, as it was acted upon by the various changes of the atmosphere.

With respect to the glass, Mr. Fox said, he thought the glass quite strong enough, or he would have made it stronger, as he had to keep it in repair for twelve months. There was an important point, which few considered when they put questions regarding glass;—they only asked what thickness it was. Now its thickness was very important, but the width was equally so. If a piece of glass, of a certain thickness and width, broke with hailstones, reduce the width, and it would be found to bear their force. The panes used by his firm were sixteen ounces to the foot, forty-nine inches long, and ten in width. During the last twelve years they had used upwards of thirty acres of glass,—a great deal of it being used at the royal dockyards and at railway stations. It had almost all been sixteen-ounce glass, though some was as low as thirteen-ounce; and, although it was spread over twelve years, they had no difficulty with it. But if, instead of ten-inch width, they had made it fifteen, it would have broken in every hailstorm: therefore the width must always be considered with the thickness.

For the supply of water to the building, to be used in the event of fire, and for other purposes, the Chelsea Water Works Com-

pany were laying a 9-inch main, with a column of 70 feet constantly on it, and a 6-inch pipe running across the building; a 6-inch pipe will run round the whole of the outside of the building, with sixteen branches into the interior; by which, with one length of hose, and without the aid of a fire-engine, they would be able to control the whole area. A special arrangement had been made with the Chelsea Water Works Company for the water to be always on; and the Company had been at the expense of an additional auxiliary engine, for the purpose of insuring a constant supply; whilst, in ordinary cases, they were bound to supply 300,000 gallons per day.

January 22nd, 1851.

THOMAS WINKWORTH, Esq.,—in the Chair.

On the history and construction of latches and locks.—By Mr. John Chubb, Member.

The paper commenced by pointing out the necessity of adopting whatever will add to the security of property. Wise laws and prompt administration do little to prevent or deter the depredations of the cunning thief. The history of the contrivances adopted, from time to time, for this end, was a very interesting one; and the author proposed to enter fully into the subject of both latches and locks.

The latches described were the simple cottage thumb-latch, in wood and in iron; the "drop-key latch," which opens by a jointed key; the "French latch," in which the key lifts vertically; the "bevil-bolt latch," ordinarily applied with Bramah's lock to street doors; and, lastly, Mr. Chubb's own "combination latch."

The first description of fastening, at all approaching to the character of a lock, of which we have any knowledge, consisted of a horizontal bar, moving into a staple or hole in the door-post. There is, in the Egyptian Room of the British Museum, a model of a granary found at Thebes, where a fastening of this kind is applied to the door,—a hole being made in the door, below the bar, for the purpose, it is presumed, of allowing a crooked key to be inserted, to move the bar backwards and forwards.

The Egyptian lock contains three loose pins, which, being situated in the staple of the door, drop into corresponding holes in the bolt, when the bolt is in its place. The key has wires or prongs, answering to the pins, by which they can be lifted to the level of the top side of the bolt, which can then be withdrawn. These pins are, in fact, tumblers. This lock is still in use in Egypt, and is to be found in some parts of Cornwall, whither it was probably brought by the Phœnicians.

The "letter lock" was invented by Cardon, about the year 1590: it consists of a combination of metal rings, bearing letters, moving round a fixed cylinder, and can only be opened when a

certain word is formed, by which the internal notches are brought into a line, so as to permit the hasp to be raised. Cardon's locks only permitted the use of one word; but by M. Regnier's subsequent improvement, a great extent of permutation was effected.

The "warded lock" differs entirely in principle from the Egyptian lock, having fixed instead of moveable obstructions to the ingress of any key or instrument intended to grapple with the bolt. It cannot be too strongly insisted on, that a warded lock, however complicated in its arrangements and beautiful in its workmanship, is, for any purpose of security, utterly worthless. An impression of the wards can easily be taken in wax, and a *fac-simile* key made, or a picklock, which, escaping all the wards, opens the bolt with as much ease as the key itself.

The true principle of safety is, after all, found in the Egyptian lock; viz., that of several separate independent and moveable tumblers, or detainers of the bolt,—each being lifted to its proper place by corresponding projections or parts of the key. Mr. Barron, in the year 1774, was the first to apply this principle; and he also effected a great improvement by means of the overlift. His lock has two tumblers, each of which must be raised simultaneously to the precise height required, so as to allow the studs to pass through the slot in the bolt. There are upper transverse notches in the bolt; so that you cannot tell, in any trial to pick it, when either tumbler, much less both, is in its proper position to let the bolt pass.

The author next proceeded to explain "Bramah's lock," patented ten years after, which consists, as is well known, of moveable notched sliders, inserted in a barrel, radiating from the key-pin, and will not allow of the bolt being thrown until these notches come into a line.

He then proceeded to describe his own construction of lock, the peculiarity of which is, that it has six separate and distinct double-acting tumblers, with the addition of a "detector;" by which, any attempt to pick or open the lock by a false key is immediately notified on the next application of the proper one.

In order to shew the necessity for secure locks and safe depositories for property, especially in banking establishments, the author gave an insight into the mode of planning large burglaries. "You will bear in mind," he said, "that an unsuccessful attempt is seldom made where the booty is of any magnitude. The first-rate 'cracksmen' always know beforehand where to go, when to go, and what they are going for. When a 'plant,' as it is termed, is made upon a house or a bank, precise information is gained, if possible, as to the depository of the valuables; and, if it is found that the safeguards are too strong in themselves, and that the locks are invulnerable, the affair is quietly dropped. But if otherwise, then no expenditure of time, or misapplied ingenuity, is spared to gain the desired end. The house is constantly watched; the habits of its inmates are observed; their ordinary times of going out and coming in are noted; the confidential

servants are bribed or cajoled, and induced to leave the premises when their employers are absent, so that impressions may be taken from the locks, and false keys made. When all the keys required are made, one or two men who have not been previously initiated are generally called in, and receive their instructions to be ready at a certain hour on the following day to enter the house. A plan of the premises is put into their hands; they are cautioned to step over a certain creaking stair or plank; and the keys of the different doors are given them. The day or evening is chosen, when it is known that the inmates will be from home—the servant, taking advantage of their absence, fulfils a long-standing engagement with his new and liberal friends—a signal is given—the two confederates enter—the so-called safe is swept of its contents—all the doors are carefully re-locked—and not until the bank is opened for business next morning is the robbery discovered.

"When a large amount of property, consisting of either cash, plate, or jewels, is deposited, it is, in fact, offering a premium to robbers, unless fit receptacles for such property are provided. Notwithstanding the cunning, ingenuity, or violence of the professional burglars, means are at hand by which they may be effectually baffled; and all who are interested in the matter should see that their so-called 'patent' locks, on iron safes, are really what they ought to be—impervious to fraud and force."

Gottlieb's, Parsons', and Strutt's locks, were said to be modifications of the tumbler lock. In various other locks, simplicity seems not to have been studied, but rather how complex both lock and key could be made, and, therefore, how inconvenient for general use.

The author remarked that, until very lately, the lock-manufacturers of England have not attended to the ornamental and decorative part of their trade. This has been caused mainly through excessive competition, and a desire to produce a cheap article; and the consequence is, that the specimens of locks and keys in use three or four hundred years since, in workmanship and finish, put to shame the rubbish now sold as sham "Bramah's," "improved patent detector," and "warranted secure" locks.

The true principles of perfect security, strength, simplicity, and durability, should be combined in every good lock.

1st. Perfect security is the principal point to be attended to; as, without it, no lock can be considered as answering the intended purpose.

2ndly. The works of a lock should, in all cases, possess strength, and be well adapted, especially in the larger ones, to resist all attempts to force them open; and, both in the larger and the smaller kinds, the works should not be susceptible of injury or derangement from attempts with picklocks or false keys.

3rdly. Simplicity of action is requisite; so that any person having the key, and being unacquainted with the mechanism of the lock, should not be able to put it out of order.

4thly. The workmanship, materials, and interior arrangement

of a lock should be so combined as to insure the permanent and perfect action of all its parts, and its durability under all ordinary circumstances.

Some beautiful drawings of ancient locks and keys were exhibited, to illustrate the paper.

January 29*th*, 1851.

THE RIGHT HON. THOMAS MILNER GIBSON, M.P., VICE-PRESIDENT,—IN THE CHAIR.

On the history and construction of the Britannia Bridge. By Mr. GEORGE GROVE, Secretary.

It was originally intended that the Chester and Holyhead Railway should cross the Menai Straits by Telford's well-known suspension bridge; but this plan was abandoned on account of engineering difficulties; and the site occupied by the present bridge was fixed on. It takes its name from the Britannia Rock, lying in mid-channel; on which its centre pier is founded. At this place Mr. R. Stephenson proposed to build a bridge of two cast-iron arches, each of 350 feet span and 100 feet in height, which were to be erected without the use of centres, by continued additions to the spandrils,—each piece being connected to its fellow on the opposite side of the pier by tie-rods. An end was put to this design by the requirement of the Admiralty that the same height should be preserved at the springing of the arch as at the crown; in other words, that its under side should be a straight line.

In this position of affairs, the conception of at ube occurred to Mr. Stephenson; and to determine its shape and the details of its construction, he was empowered by the directors of the line to make a magnificent series of experiments, which were conducted at the works, and under the care of Mr. Wm. Fairbairn, at Millwall. The first series of experiments was on 34 tubes, of three different sections, round, oval, and square or rectangular, varying in length from 18 to 27 feet, and in diameter from 9 to 18 inches. They were, in all cases, supported at their ends,—the testing weight being hung at the middle, till fracture took place. The rectangular form was found to be much the strongest: it was the only one in which failure did not take place in the upper side.

When a beam, supported at its ends, is loaded at the middle, the fibres of the top, or upper side, are compressed; while those of the bottom are stretched. When, therefore, a beam of uniform shape is broken by the failure of the top, it is evident that the strength of the material to resist compression is not equal to that with which it resists tension; and the reverse. The power of cast-iron to resist compression is to its power of resisting tension as 5 to 1; while, by these experiments, it was discovered that in wrought-iron the proportion is reversed,—its power to resist compression being to its power to resist tension as 9 to 11.

The second series was on a model tube, one-sixth of the dimen-

sions assumed for the real bridge, 75 feet long, 4 feet high, 2 feet 9 inches wide. The sides and bottom were of single plate; but the top contained six cells, or flues, running from end to end. Six experiments were made with this model, to determine the proper proportion to be kept between the material of the top and of the bottom. In the last experiment, the tube broke with 86 tons suspended—equal to 172 tons distributed over its length—the sectional area of the top being 26¼ inches, and that of the bottom 22½, or as 11 to 9 very nearly.

During these experiments, the masonry of the bridge was proceeding rapidly.

The Britannia Rock is in mid-channel; and upon it is the tower called by its name, which, at its base, is 60 feet by 50 feet 5 inches. Its entire height is 221 feet 3 inches. It is not of solid masonry; but contains a centre wall, dividing it into two wells, which are arched over under the tubes at a height of 97 feet from the base. The sides are tapered, so that at the level of the bottom of the tubes it is 51 feet 4 inches by 45 feet 5 inches.

At a distance of 460 feet on each side of the Britannia Tower stand the two land-towers on the Carnarvon and Anglesey shores. At their base they are 60 feet by 37 feet; and at the level of the tubes 51 feet 4 inches by 32 feet.

From the land-towers to the face of the abutments, which stand still further inland, is a space of 230 feet. The abutments themselves are in all 176 feet long. Each entrance is guarded by a pair of gigantic lions, carved in limestone, from the design of Mr. Thomas. The external parts of the masonry are of "Anglesey marble:" a hard mountain-limestone, full of fossils, extremely durable, and with an appearance of great solidity. This stone is backed in with Runcorn red sandstone, and with brick-work in cement.

A large number of cast-iron girders was built in to the solid stonework, for the purpose of effectually distributing the pressures of the enormous weights which were carried by certain spots during the lifting of the tube. Of these, the Britannia Tower contains no less a weight than 394 tons,—the total weight in the towers and abutments being 929 tons.

The scaffolding employed was constructed on the modern plan, with whole balks of very large timber.

The dimensions of the tubes having been definitely fixed, it was determined to build the four large ones on platforms or jetties, lying along the high-water mark of the Carnarvon shore; then to float them to the foot of the towers; and finally raise them to their places by hydraulic power. The land-tubes were to be built in their places on scaffolding.

Supposing one of the large tubes to be completed, and lying ready to be floated on the platform;—it is 472 feet long,—3 feet higher at the end which is to enter the Britannia Tower than at the other, which is 27 feet high. It has eight cells in the top, and six in the bottom; in both cases 1 foot 9 inches high, but of

different width. The platforms, forming the upper and lower sides of the top cells, are of single thickness; and they are connected with the upright plates of the cells by two angle-irons, matched on the opposite side of the plate by a flat strip. These junctions are formed by rivets, which are inserted at a red heat, and, while hot, are closed up—exerting, by their contraction, a great power on the plates through which they pass. The rivetting of the lower part of the top cells is performed with ease before the top platform is put on; but, to accomplish the rivetting of the latter, it is necessary that the "holder up" (the man who keeps the rivet in its place whilst its head is being beaten up) and his boy should be inside the cells;—which they are for hours together. While in this position, the rivets are supplied to them through small holes, left for that purpose.

The plates, forming the sides, run vertically; and they are joined together by double T-irons, which form a pillar of great strength at every two feet distance throughout the tubes. These T-irons are bent round at right angles, and rivetted to the platforms of the top and bottom; and a triangular plate, called a gusset, is used to fill the corners, with great effect, against the twisting strain exerted by the wind. The platforms of the bottom cells are of double thickness of plates, arranged so as to break joint; the covers (plates rivetted over the joints) being large and strong; the whole forming, in fact, a *chain* to resist tension;—while the top is constructed with small covers and nicely-executed joints, so as to act as a *pillar* to resist compression. The sectional area of the "top" of the tube, at the Britannia tower, is 648,—that of the "bottom," 585 square inches.

Cast-iron frames, of great strength, are fitted into each end of the tubes, and into the lower set of cells, to resist the great crushing or "shearing" strain occurring at the points of support in the towers. To these frames are fitted the iron beams to which the lifting chains are subsequently attached, and which consist of three very strong cast-iron girders, accurately fitted, having pillars of iron jammed between them, and a strap of wrought-iron passing completely round them, so as to make them all into one solid mass.

The tubes having been completed on the platforms, it was necessary that they should be cut away, that room might be made for the pontoons, by which the work of transport was to be done. Temporary stone towers were therefore built under each end, and a packing of elm planks inserted to receive the pressure of the tube. The platforms had been built with an upward curve of 9 inches; and it was found that, after they were cut away, and the tube took its own bearing, the deflection only slightly exceeded this.

The rocky beach, beneath the tubes, was next excavated to admit the pontoons. These were eight in number—six of wood, 100 feet in length, 25 feet wide, and 10 feet deep; and two of iron, of the same length, but 31 feet wide and 8 feet 9 inches

deep. They were arranged below the tube in two groups, and were divided by partitions, or bulkheads, into several compartments, each having a valve, which could be shut or opened by screws on deck, and by which any amount of water could be admitted to diminish or wholly destroy their buoyancy: they were also provided with pumps for removing this water, or any that might leak in. By keeping these valves open, the pontoons remained perfectly still below the tube till the time came for floating.

The principle on which it was determined to conduct the floating of the first tube was, that the tube should be hauled out into the flowing or rising tide, which runs in the required direction, when the velocity of the tide was such as to bring the tube to the foot of the piers just at the time of high water;—the ends of the tube being brought over stone shelves, prepared at the bases of the towers, on which, as the tide descended, it would be left resting. Thus, the tide itself was made to do the work of transport, and no exertion would be wanted, except for the purpose of pilotage.

The difficulties which had to be guarded against were enormous. A mass of 2000 tons in weight, and of the most cumbrous awkward shape imaginable, had to be navigated in a tideway where the current is often eight miles per hour, with the risk of a capricious wind springing up (as in every mountainous country they unexpectedly do), which would act with fearful effect on the huge sail-surface of the tube; this unwieldy mass had to be turned half round on its passage, and guided safely past the points of the Britannia Rock; and, lastly, there was the absolute impossibility of making any change in the arrangements as unforeseen emergencies might occur.

Two 12-inch ropes were laid down the stream from a sunk mooring, opposite the farthest tube, to two capstans on the other side of the Anglesey land-tower; and on them the tube was to travel, as a ferry-boat, on its guide-lines. They ran over the pontoons, where they passed through cable-stoppers, or contrivances by which the rope could, on occasion, be gripped so hard as to stop the motion of the whole mass. These guide-lines were buoyed up by casks, attached at intervals, to protect them from the sharp rocks of the bottom. Two 8-inch lines, leading from moorings on the opposite shore to capstans on the pontoons, were employed to haul the tube out into the stream; and five other lines, connected to powerful capstans on the shores and on the Britannia Rock, were to effect the last delicate operation of placing the tube in its ultimate position.

These capstans were fully manned by 11 superintendents, 450 labourers, 65 sailors, and 12 carpenters. Each capstan had 48 men; each set of pontoons carried 105 hands; and six boats, with spare line, attended the tube in its outward progress. The capstans were signalled-to from the tube by holding up the distinguishing letter of the capstan and a flag,—the color and position of which indicated what was required.

On the evening of the 20th of June the floating took place. The pontoons, having been rendered buoyant by the closing of the valves, rose with the tide until they reached the bottom of the tube, which was lifted clear off the temporary piers at half-past seven. The land attachments being cast off, and the capstans of the hauling-out lines set in motion, the mass swung out into the stream at a rapid pace. When the proper distance from shore had been reached, a chain, made fast to the back of the tube, was cast off, and the onward progress began. By means of the cable-stoppers, which acted admirably, the speed was kept at about $1\frac{1}{2}$ mile per hour. When about three-quarters of the journey had been performed, and the tube had begun to take a position close to the Britannia Rock, and oblique to the course of the tide, a delay arose, owing to an accident at the "Llanfair Capstan," on the Anglesey shore, where the coils of the rope over-rode one another, and prevented the motion of the capstan; as the tube, therefore, floated on, it dragged the capstan from its frame; and, but for the superintendant of the capstan inducing the crowd of lookers-on to take hold of the long end of the rope, and by the weight of hundreds prevent its further slipping, there is much cause to fear that the pontoons would have grounded on the Britannia Rock, and the whole have been wrecked.

The key to the concluding steps of the floating was a pile of timber and stonework, beyond, but close to, the Anglesey land-tower, called the "Anglesey Butt:" against this, as a pivot, the tube was to bear while being veered across the opening, at right angles to the line of the current. Up to this it was hauled by a powerful crab behind the Butt; after which, the delicate operations necessary for inserting the high end into the recess in the Britannia tower (only two inches wider than the tube in its obliqe position) were performed by the two capstans and the large crab on the Britannia Rock. The tube having been hauled home at the Britannia Tower, it only remained to bring it into the open recess in the land-tower, which was done at twenty-two minutes past nine, when the welcome "All right!" of Mr. Stephenson was the signal for loud and prolonged cheering and firing of cannon. As the tide ebbed, the pontoons floated away from below, leaving the tube to span the opening with no real or imaginary assistance.

The tube having reached its destination at the foot of the piers, the next operation was to lift it through the 100 feet between that position and its ultimate place. This was done by hydraulic presses of enormous dimensions; that at the Anglesey end having a ram of 20 inches diameter, and a cylinder 10 inches thick; and that at the Britannia end, two cylinders, with rams 18 inches diameter. The ram carried a crosshead of prodigious strength, of cast-iron, strengthened on the top side by wrought-iron links, put on hot; from it depended the lifting-chains,—the lower ends of which were secured to the beams in the end of the tube. The "stroke" of the press, or the height which it was capable of lifting through,

was six feet, and each link of the lifting-chains corresponded in length. These were formed like those of a suspension bridge, alternately of eight and nine bars. On the upper part of the frame of the press, 12 feet below the top of the crosshead when at the highest point of its lift, was an arrangement of "clams," which were blocks of iron, planed accurately to fit the square shoulders of the head of the chain: by screws and gearing these clams could be opened or closed, so as to let the chain pass, or to embrace and hold it firmly. On the crosshead was a precisely similar arrangement. When, therefore, the press had completed its lift of six feet, the head of the third link had just reached the level of the clams. These being brought in under the shoulders of the link, transferred to themselves the weight of the dependent tube. The clams on the crossheads were then opened, the ram lowered, the top link taken off, the crosshead clams closed, and the bottom clams opened, when all was ready for another lift of six feet.

The whole of this ponderous machinery was supported on beams of wrought-iron, of immense strength, which spanned the tower above the tube.

The time occupied in making each lift of six feet was about 38 minutes. The precaution was taken to underbuild the tube with brickwork in cement, filling up the recess in the towers. During the lift, a packing of thin wood was introduced between the top of the brickwork and the bottom of the tube, that, in case of accident, an inch might be the greatest distance fallen through. That these precautions were not needless was shewn on the 17th of August, when the bottom of the cylinder of the single press broke, and allowed the tube to descend on to the packing. No serious injury was done to the tube, though the delay in procuring a new cylinder was considerable. On the 13th of October the full height was reached.

The expansion and contraction of such a length of metal is considerable, even under ordinary changes of temperature. Its effects are rendered more manageable by allowing the tube to rest in the Britannia tower, and to expand outwards in both directions,—there being arrangements of rollers, &c., in the land towers and abutments, to facilitate its motion, The greatest motion hitherto observed in each half is $3\frac{3}{16}$ inches. By a simple arrangement of clockwork moving a ruled paper (the tube itself carrying a pencil), a daily register of this motion is kept.

The second tube was floated on the 4th of December, and lifted to its place on the 7th January, 1850. The last of the land tubes of the first line was lowered to its place on the 4th March, and on the 5th, Mr. Stephenson and staff passed through with a monster train, drawn by three locomotives.

Ten days after this, the line was tested by the Government Inspector, with a train 434 feet long,—causing a deflection of not $\frac{3}{4}$ inch.

The third tube was floated on the 10th June, and deposited on

its permanent bed on the 11th July. The fourth tube was floated on the 25th of the same month, and placed on the 12th September.

The total weight of the tubes is nearly 11,000 tons. This weight is made up of 9360 tons of wrought-iron, and more than 1200 tons of cast-iron and timber. They are composed of about 186,000 separate pieces of iron, pierced by more than 7,000,000 of holes, and united by upwards of 2,000,000 of rivets,—the angle and T-iron being not less than 83 miles in length. The weight of the lifting chains alone, at each end of the tube, was more than 40 tons, which, with the cross-head and ram of the press, made a total of more than 60 tons to be lifted before any effect could be produced on the tube itself. Of the masonry in the towers and abutments, there were about 1,500,000 of cubic feet;—the weight in all being 150,000 tons. Allowing twelve working hours in the day, and six days to the week, this masonry was prepared and laid at the rate of three cubic feet per minute during the whole time of its construction.

The resident engineers, to whose charge the execution of the masonry and ironwork was confided, were, respectively, Mr. Frank Forster and Mr. Edwin Clark. The designs for the masonry were by Mr. Francis Thomson.

One of the tubes was constructed by Messrs. Garforth; and the remainder by Mr. Charles Mare. The hydraulic presses and lifting arrangements were elaborated by Messrs. Easton and Amos; and the contractors for the masonry were Messrs. Nowell, Hemingway, and Pearson.

Scientific Adjudication.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

February 10th, 1851.

Present,—Lord Langdale; The Right Hon. T. Pemberton Leigh; The Right Hon. Dr. Lushington; & The Right Hon. Sir E. Ryan.

COOKE AND WHEATSTONE'S PATENT.

This was an application by the Electric Telegraph Company for the extension of a patent granted to Mr. Wm. Fothergill Cooke and Charles Wheatstone, on June 12th, 1837, for "improvements in giving signals and sounding alarms at distant places by means of electric currents transmitted through metallic circuits;"—which patent had become the property of the Company by purchase. The petitioners presented a statement of their receipts and disbursments up to December 31st, 1850, to prove that they had not received an adequate return upon the amount of capital invested. Evidence was given as to the general management and position of the undertaking—the accuracy of the accounts—the reasonable charges made by the Company for the transmission of intelligence, &c.

Lord Langdale, in giving judgment, said it appeared that the inventors (Cooke and Wheatstone) had been sufficiently re-

warded for their ingenuity by the large sums of money received for the patent right. He also stated that if the Company's speculation had been clearly made out to be a losing concern, it would, perhaps, have been matter for consideration whether there was not some good ground for a renewal; but their Lordships were of opinion that the speculation had proved to be profitable: although, instead of paying dividends, the profits had been carried to the capital account to relieve the shareholders, that did not make it less a profitable concern.

The judgment of their Lordships was, therefore, against the renewal of the patent.

COURT OF COMMON PLEAS.

WESTMINSTER HALL.—FEB. 11th, 1851.

Sittings at Nisi Prius,—before LORD CHIEF JUSTICE JERVIS.

DENLEY *v.* BLORE.

THIS was an action for the infringement of a patent granted to William Denley, the plaintiff, on the 21st September, 1843, for "certain improvements in the construction of fire-places, flues, and chimneys." The part of the invention which it was alleged had been infringed consisted in constructing flues or chimneys of a series of earthenware tubes or pipes, either round, oval, or of any other convenient form, and set in brick-work in a peculiar manner. The defendant was the architect under whose directions the alterations at Buckingham Palace were made; and it was stated that in this building the plaintiff's invention had been adopted without his permission or license.

The Lord Chief Justice suggested that the action had been brought against the wrong party, and that it was the contractor for the alterations in the building, and not the architect, who should be sued for the infringement of the patent right. The counsel for the plaintiff took the same view of the case. The plaintiff was therefore non-suited by consent.

COURT OF QUEEN'S BENCH,

GUILDHALL, FEB. 20TH, 1851.

Sittings at Nisi Prius,—before LORD CAMPBELL *and a Special Jury.*

NEWALL *v.* WILKINS AND ANOTHER.

Sir F. Thesiger, Mr. Watson, Q.C., Mr. Webster, and Mr. Denison appeared for the plaintiff; and the Solicitor-General, Mr. M. Chambers, Q.C., and Mr. Hindmarch, for the defendants.

This was an action to recover damages for the infringement, by the defendants, of a patent granted to the plaintiff on the 7th of August, 1840, for "improvements in wire ropes, and in machinery for making such ropes." The plaintiff had, for the last ten years, been carrying on the manufacture of these ropes at Gateshead, and had also a place of business in the Strand, near

Waterloo-bridge. The defendants, Messrs. Wilkins and Wetherby, carried on their business in High-street, Wapping, and professed to manufacture ropes according to a patent which had been previously granted to Mr. Andrew Smith, whose licensees they were in the month of March, 1839. The method of making ropes of wires was of comparatively recent introduction. In the first instance they were made of wires laid horizontally, and bound together with bands. Subsequently they were made in the same manner as hempen ropes. In making ordinary ropes, the hemp was first spun into yarn, and the yarns were then twisted into strands, and several of these strands were again twisted, so as to form a rope. But, in making wire ropes, it was found that the twist which was given to the wire in forming the strands, and afterwards to the strands in making them into ropes, was injurious to the strength of the rope. It was therefore a great object to make wires in such a way that the twist in the strands might be avoided, and also the twists which were given to the strands in forming them into ropes. It was chiefly for effecting this improvement that the plaintiff had obtained his patent. There were also some other improvements which the plaintiff claimed, which he summed up thus:—"I claim, first, the method of making ropes, whereby the individual wires are prevented from being twisted in themselves. Secondly, the method of making wire ropes by laying wires round a core to form a strand, and by laying strands round a core to form a rope, when the number of wires or strands exceeds three: whereby the wires forming the strands, and the strands forming the rope, are kept at equal distances from their centres. Thirdly, the laying wires into strands and the strands into ropes at one and the same time." The defendants, as is usual in actions of this kind, pleaded a great number of pleas; the principal of which were, that the specification was defective, and that the plaintiff's invention was not a new invention.

In support of the plaintiff's case, several witnesses were called to prove that the specification was sufficient; that the invention was properly described therein; and that any mechanic, of ordinary skill, could make the machine from the description and drawings. Other witnesses were called to prove the utility and novelty of the invention; and it was stated, on behalf of the plaintiff, that, before the date of his patent, wire ropes had never been made without the individual wires having been twisted, which injured the fibres of the metal, and, consequently, impaired the quality of the rope. Reference having been made to some proceedings in Chancery, relating to the plaintiff's patent, wherein the parties to the present suit were interested, it was further stated on behalf of the plaintiff, that it would be impossible to make wire rope, with the wires untwisted in themselves, on any of the machines employed for making hempen rope prior to 1840, the date of the plaintiff's patent.

The defendants endeavoured to shew that the manufacture of

wire rope, in which the individual wires were untwisted in themselves, was not a new invention in 1840, inasmuch as it had already been made public by a patent granted to Mr. Andrew Smith in the year 1839. It appeared by Mr. Smith's specification that his invention was for making ropes of wire, instead of hemp, by any of the processes by which rope was then made; and the question raised by the defendants was, chiefly, as to whether by the methods in common use ropes could be made without giving a twist to the individual wires or strands. In support of this view, witnesses were called to shew that it was perfectly possible to make wire ropes on machines known and in use long prior to 1840, without twisting the individual wires. It was shewn that Grimshaw's, Huddart's, and other rope-making machines would (by simply altering to a very slight extent the number of the teeth in some of the wheels) make the wire rope in the manner proposed by the plaintiff. Mr. Smith was called, and stated that he had, before the date of the plaintiff's patent, made wire rope in which the individual wires were untwisted; and that he deposited specimens of the said untwisted wire rope at the Polytechnic Institution in 1838, and with the Admiralty in the early part of 1840. These specimens were produced by the officers with whom they were deposited, and were identified by Mr. Smith as his manufacture.

In order to rebut this testimony, which, if true, would be fatal to the plaintiff's claim of novelty, the witnesses on behalf of the defendant were submitted to a very rigid cross-examination, for the purpose of shewing that the specimens produced as Mr. Smith's manufacture, were mixed up with specimens of wire rope made by other persons; and that, during the changes and alterations that had from time to time been made at the Polytechnic Institution, in the arrangement and classification of the numerous articles there deposited, it was possible that mistakes might have arisen in renumbering and cataloguing the articles. It appeared that Messrs. Hyman and Cupar, in the year 1841, also deposited several specimens of wire rope at the Polytechnic Institution; and upon Mr. Cupar being examined, he stated that the specimens claimed by Mr. Smith, were, in fact, made and deposited by him. In support of Mr. Cupar's evidence one of his foremen was called, who swore that he himself made, under Mr. Cupar's directions, the specimens of wire rope claimed by Mr. Smith.

The Solicitor-General then addressed the jury upon the evidence that had been brought forward by the plaintiff on this point, and pointed out the improbability of the story told on behalf of the plaintiff,—stating, that the officers of the Polytechnic Institution could have no object or interest in stating that which was untrue, and that the probabilities of the case were in favor of the statement made on behalf of the defendants, viz.,—that the specimens were made and deposited by Mr. Smith, as alleged by him and supported by other testimony.

The Lord Chief Justice, in summing up, recapitulated the whole of the evidence, and dwelt upon those points which he

thought most worthy of the attention of the jury. He stated that all sides were agreed as to the utility of the invention, but that the evidence as to the novelty of the invention was most conflicting; and it would be for them to decide whether, before the date of the plaintiff's patent, wire rope with untwisted wires had been, or could be made by the machinery then known and in use. His Lordship then read over the evidence relating to the specimens deposited at the Polytechnic Institution; remarking upon its contradictory character, and leaving it to the jury to decide as to which statement they should believe.

After a long absence from court, the jury returned and gave a verdict for the plaintiff on all the issues, with damages one shilling.

List of Patents

Granted for SCOTLAND, subsequent to January 22nd, 1851.

To James Slater and John Nuttall Slater, of Dunscar, near Bolton-le-Moors, county of Lancaster, bleachers, for certain improvements in machinery or apparatus for the purpose of stretching and opening textile or woven fabrics.—Sealed 23rd January.

James Hamilton, of London, engineer, for improvements in machinery for sawing, boring, and shaping wood.—Sealed 23rd Jan.

Julian Bernard, of Green-street, Grosvenor-square, London, for improvements in the manufacture or production of boots and shoes, and other articles made of leather, dressed skins, or other materials; and in the materials and machinery or apparatus to be employed therein,—being a communication.—Sealed 24th January.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of 166, Fleet-street, London, patent agents, for certain improvements in steam machinery, and apparatus connected therewith,—being a communication.—Sealed 24th January.

Richard Archibald Brooman, of Fleet-street, London, for an improvement or improvements in abdominal supporters,—being a communication.—Sealed 24th January.

Charles de Bergue, of Arthur-street West, London, engineer, for improvements on and in the construction of the permanent way of railways.—Sealed 27th January.

Samuel Clift, of Bradford, manufacturing chemist, for improvements in the manufacture of muriatic acid, soda, potash, and glass, and of chlorine.—Sealed 27th January.

William Beckett Johnson, of Manchester, manager for Messrs. Ormerod and Son, engineers, for certain improvements in steam-engines, and in apparatus for generating steam; such improvements in engines being wholly or in part applicable where either vapour or gases are used as the motive power.—Sealed 29th January.

Samuel Morand, of Manchester, for improvements in apparatus used when stretching and drying fabrics.—Sealed 29th January.

Edward David Ashe, of Brompton, London, Lieutenant R. N., for a new or improved nautical instrument or instruments applicable especially, among other purposes, to those of great circle sailing.—Sealed 29th January.

William Mc Gavin, of Glasgow, for certain improvements in steam-boilers, and furnaces, and fire-places, and in the prevention of smoke.—Sealed 29th January

Joshua Horton, of Ætna Works, Smethwick, in the county of Stafford, steam-engine boiler and gas-holder manufacturer, trading under the firm and style of Joshua and William Horton, for improvements in the construction of gas-holders.—Sealed 30th January.

Peter Fairbairn, of Leeds, machinist, and John Hetherington, of Manchester, machinist, for certain improvements in moulding for casting pipes, railings, gates, agricultural implements, and other metal articles; and also in preparing patterns or models for the same.—Sealed 31st January.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels; parts of which improvements are applicable to steam-engines and pumps.—Sealed 31st January.

Benjamin Rotch, of Lowlands, Middlesex, for a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes,—being a communication.—Sealed 3rd February.

Nathaniel Jones Amies, of Manchester, for certain improvements in the mauufacture of braid, and in the machinery or apparatus connected therewith.—Sealed 3rd February.

Frederick Watson, of Moss-lane, Hulme, Manchester, for improvements in sails, rigging, and ships' fittings, and machinery and apparatus employed therein.—Sealed 3rd February.

James Webster, of Leicester, engineer, for improvements in the construction and means of applying carriage and certain other springs.—Sealed 5th February.

Henry Bessemer, of Baxter House, civil engineer, for certain improvements in the sugar-cane press.—Sealed 6th February.

Selim Richard St. Clair Massiah, of Alderman-walk, New Broad-street, London, for improvements in the manufacture of artificial marble and stone, and in treating marble and stone.—Sealed 7th February,

Joseph Shaw, of Paddock, near Huddersfield, cloth-finisher, for improvements in constructing and working certain parts of railways.—Sealed 7th February.

Francis Clark Monatis, of Earlston, Berwickshire, builder, for an improved hydraulic syphon.—Sealed 7th February.

Richard Stuart Norris, of Warrington, for certain improvements in the construction of the permanent way of railways, bridges, locks, and other erections wholly or in part constructed of metal; also improvements in brakes for railway carriages.—Sealed 10th February.

William Weild, of Manchester, engineer, for improvements in machinery for turning and burnishing.—Sealed 10th February.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, London, civil engineer, for improvements in machinery or apparatus for producing ice, and for general refrigeratory purposes,—being a communication.—Sealed 11th February.

Ewald Riepe, of Finsbury-square, London, merchant, for improvements in refining steel,—being a communication.—Sealed 12th February.

Peter Claussen, of Cranbourne-street, London, for certain improvements in bleaching; in the preparation of materials for spinning and felting; in yarns and felts; and in the machinery employed therein; part of which improvements have been communicated to him by a foreigner residing abroad.—Sealed 12th February.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, London, mechanical draughtsman, for improvements in manufacturing looped and other woven fabrics,—being a communication.—Sealed 14th February.

Charles Gotthelf Kind, of Paris, engineer, and Charles Alexis de Wendel, of Paris, iron-master, for improvements in the process and instruments to be used for boring the earth and sinking shafts, of any given diameter, for mining and other purposes; and in the means of lining such shafts.—Sealed 14th February.

James Thomson Wilson, of Stratford-le-Bow, London, chemist, for improvements in the manufacture of alum, and in obtaining ammonia.—Sealed 14th February.

David Ferdinand Masnata, of Golden-square, London, for a new mechanical system with compressed air, adapted to obtain a new moving power.—Sealed 17th February.

William Burgess, of Newgate-street, London, gutta-percha dealer, for improvements in machinery for cutting turnips and other substances.—Sealed 17th February.

Thomas Wicksteed, of Old Ford, in the county of Middlesex, civil engineer, for improvements in the manufacture of manure.—Sealed 17th February.

Bennet Woodcroft, of Furnival's Inn, for improvements in machinery for propelling vessels.—Sealed 21st February.

New Patents
SEALED IN ENGLAND.
1851.

To Samuel Morand, of Manchester, for improvements in apparatus used when stretching and drying fabrics. Sealed 30th January—6 months for inrolment.

Bennet Woodcroft, of Furnival's Inn, for improvements in ma-

chinery for propelling vessels. Sealed 30th January—6 months for inrolment.

James Murdock, of Staple Inn, in the county of Middlesex, patent agent, for certain improvements in preserving animal and vegetable substances,—being a communication. Sealed 30th January—6 months for inrolment.

Charles Gotthelf Kind, of Paris, in the Republic of France, engineer, and Charles Alexis de Wendel, iron-master, also of Paris, in the Republic of France, for improvements in the process and instruments to be used for boring the earth and sinking shafts, of any given diameter, for mining and other purposes, and in the means of lining such shafts. Sealed 30th January —6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, mechanical draughtsman, for improvements in manufacturing looped and other woven fabrics,—being a communication. Sealed 30th January—6 months for inrolment.

Richard Johnson, of Manchester, in the county of Lancaster, wire-drawer, for certain improvements in annealing articles of iron and other materials. Sealed 31st January—6 months for inrolment.

Juan Nepomuceno Adorno, of Golden-square, in the county of Middlesex, Gent., for improvements in the construction of maps and globes, and in apparatus for mounting the same. Sealed 31st January—6 months for inrolment.

Charles Marsden, of Kingsland-road, in the county of Middlesex, engineer, for certain improvements in boots and shoes. Sealed 31st January—6 months for inrolment.

George Bradshaw, of Bishopsgate-street Within, in the City of London, hosier, for certain improvements in fastenings for garments. Sealed 31st January—6 months for inrolment.

Jean Paul Gage, of Paris, in the Republic of France, chemist, for improved chemical compounds for tissue bandages, wafers, and also for surgical purposes. Sealed 31st January—6 months for inrolment.

David Davies, of Wigmore-street, Cavendish-square, in the county of Middlesex, coach maker, for certain improvements in the construction of wheel carriages; and in appendages thereto. Sealed 31st January—6 months for inrolment.

John Davie Morris Stirling, of Black Grange, North Britain, Esq., for improvements in the manufacture of metallic sheets; in coating metals; in metallic compounds; and in welding. Sealed 31st January—6 months for inrolment.

Samuel Allen, jun., of Birmingham, in the county of Warwick, manufacturer, for certain improvements in the manufacture of buttons. Sealed 1st February—6 months for inrolment.

Nathaniel Jones Amies, of Manchester, manufacturer, for certain improvements in the manufacture of braid; and in the machinery or apparatus connected therewith. Sealed 1st February—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in communicating intelligence by electricity,—being a communication. Sealed 3rd February—6 months for inrolment.

Alexander Alliott, of Lenton Works, in the county of Nottingham, engineer, for improvements in cleaning, dyeing, and drying machines; and in machinery to be used in sugar, soap, metal, and colour manufacturing. Sealed 3rd February—6 months for inrolment.

Benjamin Ledger Shaw, of Huddersfield, for improvements in cleaning and preparing wool and other fibrous or textile materials; and in the manufacture of coloured yarns, of wool, and other fibres; and in weaving. Sealed 5th February—6 months for inrolment.

Angier March Perkins, of Francis-street, Regent-square, in the county of Middlesex, engineer, for improvements in railway axles and boxes. Sealed 5th February—6 months for inrolment.

Charles De Bergue, of Arthur-street West, in the City of London, engineer, for improvements in, and in the construction of, the permanent way of railways. Sealed 7th February—6 months for inrolment.

Frederick R. Robinson, of Boston, in the state of Massachusetts, of the United States of North America, for a new and useful sewing machine. Sealed 5th February—6 months for inrolment.

William Onions, of Southwark, in the county of Surrey, engineer, for improvements in the manufacture of certain parts of machinery used in spinning. Sealed 7th February—6 months for inrolment.

William Onions, of Southwark, in the county of Surrey, engineer, for certain improvements in the manufacture of steel. Sealed 7th February—6 months for inrolment.

François Marcelin Aristide Dumont, of Paris, engineer, for improved means and electric apparatus for transmitting intelligence. Sealed 7th February—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in apparatus for milking animals,—being a communication. Sealed 10th February—6 months for inrolment.

Peter Fairbairn, of Leeds, in the county of York, machinist, and John Hetherington, of Manchester, machinist, for certain improvements in moulding for casting pipes, railings, gates, agricultural implements, and other metal articles; and also in preparing patterns or models for the same. Sealed 10th February—6 months for inrolment.

Richard Stuart Norris, of Warrington, in the county of Lancaster, civil engineer, for certain improvements in the construction of

the permanent way of railways, bridges, locks, and other erections, wholly or in part constructed of metal; also improvements in brakes for railway carriages. Sealed 10th February —6 months for inrolment.

John Stephens, of the Albynes, in the parish of Astley Abbotts, in the county of Salop, Gent., for certain improvements in thrashing machinery. Sealed 10th February—6 months for inrolment.

Joseph Haythorne Reed, late of the 17th Lancers, of the Harrow-road, in the county of Middlesex, Gent., for improvements in saddlery and harness. Sealed 10th February—6 months for inrolment.

John Harcourt Brown, of Fir Cottage, Putney, Surrey, Gent., for certain improvements in the construction and building of ships, boats, buoys, rafts, and other vessels and appliances for preserving life and property at sea. Sealed 10th February—6 months for inrolment.

Charles Xavier Thomas (de Colmar), Chevalier de la Legion d'Honneur, of Paris, in France, for an improved calculating machine, which he calls "arithmometer."—Sealed 10th February—6 months for inrolment.

William Weild, of Manchester, in the county of Lancaster, engineer, for improvements in machinery for turning and burnishing. Sealed 11th February—6 months for inrolment.

Benjamin Heywood, of Water-street, Manchester, coach-builder, for certain improvements in railway and other carriages. Sealed 11th February—6 months for inrolment.

George Briand, of Nicholas-lane, in the City of London, surveyor, and Richard Fell, of the City-road, in the county of Middlesex, engineer, for certain improvements in obtaining fresh and pure water from salt sea and other waters. Sealed 11th February—6 months for inrolment.

Charles Howland, of New York, in the United States of America, engineer, for improvements in bell telegraphs,—being a communication. Sealed 11th February—6 months for inrolment.

Angier March Perkins, of Francis-street, Regent-square, in the county of Middlesex, engineer, for improvements in constructing and heating ovens. Sealed 11th February—6 months for inrolment.

James Webster, of Leicester, engineer, for improvements in the construction and means of applying carriage and certain other springs. Sealed 11th February—6 months for inrolment.

Edwin Ullmer, of the firm of Edwin and William Ullmer, of Fetter-lane, in the City of London, printing press makers, for certain improvements in printing presses. Sealed 12th February—6 months for inrolment.

Charles William Tupper, of Oxford-terrace, in the county of Middlesex, Gent., and Alphonse René le Mire de Normandy, of Dalston, in the same county, Gent., for improvements in the

manufacture of iron coated with other metal, commonly called galvanized iron. Sealed 12th February—6 months for inrolment.

Charles Cowper, of 20, Southampton-buildings, Chancery-lane, patent agent, for improvements in moulds for electro-metallurgy. Sealed 17th February—6 months for inrolment.

Henry François Marie de Pons, of 24, Boulevart Poissonniere, Paris, in France, Gent., for improvements in constructing roads and ways, and pavements of streets, and the ballast of railways. Sealed 17th February—6 months for inrolment.

Gustav Adolph Bucholz, of Norfolk-street, Strand, in the county of Middlesex, civil engineer, for improvements in motive power; and in propulsion. Sealed 17th February—6 months for inrolment.

David Ferdinand Masuata, of Golden-square, Regent-street, in the county of Middlesex, Gent., for a new mechanical system with compressed air, adapted to obtain a new moving power. Sealed 18th February—6 months for inrolment.

Thomas Dickason Rotch, of Furnival's-inn, Gent., for improvements in centrifugal apparatus for separating fluid from other matters. Sealed 18th February—6 months for inrolment.

William Beadon, jun., of Taunton, in the county of Somerset, Gent., for improvements applicable to the roofing of houses, buildings, and other structures. Sealed 18th February—6 months for inrolment.

Hugh Lee Pattinson, of Scots House, Gateshead, manufacturing chemist, for improvements in the manufacture of Pattinson's oxichloride of lead. Sealed 18th February—6 months for inrolment.

Henry Richardson, of Aber Hourant Bala, North Wales, Esq., for certain improvements in life boats. Sealed 22nd February—6 months for inrolment.

Edward Lloyd, of Dee Valley, near Corwen, Merionethshire, North Wales, engineer, for certain improvements in steam-engines; which improvements are in part or on the whole applicable to other motive engines. Sealed 24th February—6 months for inrolment.

Peter Wood, of the firm of Bury & Co., dyers, finishers, and calenderers, of Salford, in the county of Lancaster, for improvements in printing, staining, figuring, and ornamenting woven and textile fabrics, wood, leather, or any other material, substance, or composition; and in machinery and apparatus employed therein. Sealed 24th February—6 months for inrolment.

John Hinks, of Birmingham, manufacturer, and James Vero, of Burbage, in the county of Leicester, manufacturer, for certain improvements in the manufacture of hats, caps, bonnets, and other coverings for the head. Sealed 24th February—6 months for inrolment.

Gabriel Didier Fevre, of Paris, Gent., for certain improvements in apparatus for manufacturing and containing soda-water and other gaseous liquids; and also in preserving other substances from evaporation. Sealed 24th February—6 months for inrolment.

Thomas Wicksteed, of Old Ford, in the county of Middlesex, civil engineer, for improvements in the manufacture of manure, and in machinery to be used therein. Sealed 24th February—6 months for inrolment.

Robert Adams, of King William-street, in the City of London, gun-maker, for improvements in rifles and other fire-arms,—being a communication. Sealed 24th February—6 months for inrolment.

Francis Clark Monatis, of Earlston, in the county of Warwick, builder, for an improved hydraulic syphon,—being a communication. Sealed 24th February—6 months for inrolment.

Isaac Lowthian Bell, of Washington Chemical Works, near Newcastle-upon-Tyne, chemical manufacturer, for improvements in the manufacture of sulphuric acid. Sealed 24th February—6 months for inrolment.

Henry Dircks, of Moorgate-street, in the City of London, engineer, for improvements in the manufacture of gas, in gas-burners, and in apparatus for heating by gas. Sealed 24th February—6 months for inrolment.

Charles Frederick Bielefeld, of Wellington-street North, Strand, in the county of Middlesex, papier-maché manufacturer, for improvements in the manufacture of sheets of papier-maché, or substances in the nature thereof. Sealed 24th February—6 months for inrolment.

Samuel Cunliffe Lister, of Manningham, near Bradford, in the county of York, for improvements in preparing and combing wool and other fibrous materials. Sealed 24th February—6 months for inrolment.

Robert Hawthorn, and William Hawthorn, of the borough and county of Newcastle-upon-Tyne, engineers and partners, for improvements in locomotive engines; part of which are applicable to other steam-engines. Sealed 24th February—6 months for inrolment.

William Stones, of Queenhithe, in the City of London, stationer, for improvements in the manufacture of safety-paper for bankers' cheques, bills of exchange, and other like purposes. Sealed 24th February.—6 months for inrolment.

Amédée François Remond, of Birmingham, Gent., for improvements in the manufacture of metallic tubes or pipes, and the machinery or apparatus connected therewith; which improvements are applicable to other like purposes. Sealed 26th February—6 months for inrolment.

Disclaimers and Amendments

OF PARTS OF INVENTIONS

Made under Lord Brougham's Act,—subsequent to October 1st, 1850.

Disclaimer and memorandum of alteration filed with the Clerk of the Patents of England, on the 16th day of November, 1850, by John Ridgway, of Cauldon-place, in the county of Stafford, china manufacturer, assignee of a patent granted to George Robins Booth, of Hanley, in the county of Stafford, manufacturer and chemist, and bearing date at Westminster, the 15th day of June, 1843, for an invention of "a certain improved mode of applying heat, from various combustibles, to manufacturing and other useful purposes."

Disclaimer filed with the Clerk of the Patents of England, on the 7th day of December, 1850, to part of the title of a patent granted to William Newton, of Chancery-lane, in the county of Middlesex, civil engineer, on the 8th day of June, 1850, for an invention of "certain improvements in the manufacture of cords, ropes, bands, strong cloths, quiltings, sacks, and cushions, and in elastic material for stuffing the latter; in which manufacture caoutchouc forms an essential ingredient; and in the application of parts of these improvements to the manufacture of pads, stoppers, tubes, boxes, baskets, coverings, wrappers, and other like articles of utility,"—being a communication.

Disclaimer and memorandum of alteration filed with the Clerk of the Patents of England, on the 19th day of December, 1850, by Charles Greenway, to the title of a patent granted to him on the 19th day of June, 1850, for an invention of "improvements in ships' and other pumps, in anchors, and in propelling vessels."

Disclaimer filed with the Clerk of the Patents of England, on the 11th day of January, 1851, by John Mc Bride, of the Firm of Mc Bride and Company, cotton spinners, and power-loom cloth manufacturers, Albyn Works, Glasgow, to parts of a specification of a patent granted to him on the 12th day of November, 1846, for an invention of "improvements in weaving."

Disclaimer and memorandum of alteration filed with the Clerk of the Patents of England, on the 6th day of February, 1851, by John Aston, of Birmingham, assigneee of a patent granted to John Fielding Empson, of Birmingham, for "certain improvements in the construction and mannfacture of buttons and other fastenings for dress," dated 16th January, 1844, whereby he disclaims certain parts of the specification of the said patent.

CELESTIAL PHENOMENA FOR MARCH, 1851.

D.	H.	M.	
1			Clock before the ☉ 12m. 40s.
	—		☽ rises 6h. 28m. M.
	—		☽ pass mer. 11h. 10m. M.
	—		☽ sets 3h. 57m. A.
	3		☽ in Apogee
3	1	15	Ecliptic conj. or ● new moon
4	1	38	♃'s first sat. will im.
4	22	48	Vesta in □ with the ☉
5			Clock before the ☉ 11m. 49s.
	—		☽ rises 7h. 57m. M.
	—		☽ pass mer. 2h. 2m. A.
	—		☽ sets 8h. 18m. A.
	13	31	♄ in conj. with the ☽ diff. of dec. 5. 52. N.
6	5	57	♅ in conj. with the ☽ diff. of dec. 4. 55. N.
7			Occul. B.A.C., 845, im. 8h. 43m. em. 9h. 42m.
8	10	30	♃'s second sat. will im.
9			Occul. 63 Tauri, im. 6h. 56m. em. 7h. 48m.
	9	31	♃'s third sat will im.
10			Clock before the ☉ 10m. 36s.
	—		☽ rises 10h. 3m. M.
	—		☽ pass mer. 5h. 57m. A.
	—		☽ sets 0h. 50m. M.
	0	2	♃'s third sat. will em.
	9	45	☽ in □ or first quarter
11			Occul. γ Geminorum, im. 12h. 48m. em. 13h. 27m.
	8	32	♃'s first. sat. will im.
12	10	0	♃'s first sat. will im.
13			Occul. d^1 Cancri, im. 9h. 21m. em. 10h. 10m.
	—		Occul. θ Cancri, im 13h. 10m. em. 14h. 6m.
14			Mercury R. A. 22h. 39m. dec. 10. 57. S.
	—		Venus R. A. 20h. 37m. dec. 17. 0. S.
	—		Mars R. A. 21h. 58m. dec. 13. 36. S.
	—		Vesta, R. A., 17h. 6m. dec. 16. 1. S.
	—		Juno, R. A., 17h. 40m. dec. 10. 11. S.
	—		Pallas, R. A., 23h. 46m. dec. 3. 29. S.

D.	H.	M.	
14			Ceres R. A. 1h. 40m. dec. 4. 7. N.
	—		Jupiter R. A. 13h. 20m. dec. 6. 47. S.
	—		Saturn R. A. 1h 17m. dec. 5. 46. N.
	—		Uranus R. A. 1h. 45m. dec. 10. 23. N.
	—		Mercury pass mer. 23h. 15m.
	—		Venus pass mer. 21h. 12m.
	—		Mars pass mer. 22h. 31m.
	—		Jupiter pass mer. 13h. 51m.
	—		Saturn pass mer. 1h. 51m.
	—		Uranus pass mer. 2h. 19m.
15			Clock before the ☉ 9m. 13s.
	—		☽ rises 3h. 20m. A.
	—		☽ pass mer. 10h. 48m. A.
	—		☽ sets 5h. 28m. M.
16			☽ in Perigee
	1	5	♃'s second sat. will im.
	2	46	Juno in □ with the ☉
17	1	29	♃'s third sat. will im.
	1	49	Ecliptic oppo. or ○ full moon
	13	53	Pallas in conj. with the ☉
18	4	0	Ceres in conj. with ♅ diff. of dec. 5. 38. S.
	13	59	♃ in conj. with the ☽ diff. of dec. 3. 38. S.
19	11	54	♃'s first sat. will im.
	15	23	☿ greatest hel. lat. S.
20			Clock before the ☉ 7m. 45s.
	—		☽ rises 10h. 11m. A.
	—		☽ pass mer. 2h. 26m. M.
	—		☽ sets 7h. 48m. M.
	16	25	☉ enters Aries
23	3	40	♃'s second sat. will im.
24	1	26	☽ in □ or last quarter
25			Clock before the ☉ 6m. 13s.
	—		☽ rises 2h. 34m. M.
	—		☽ pass mer. 6h. 44m. M.
	—		☽ sets 10h. 54m. M.
27	1	47	♃'s first sat. will im.
	1	53	☿ in conj. with Pallas
28	4	5	♀ in conj. with the ☽ diff. of dec. 2. 3. N.
	8	16	♃'s first sat. will im.
	11	0	☽ in Apogee
29	12	45	♂ in conj. with the
	18	0	♂ greatest hel. lat. S.

J. LEWTHWAITE, Rotherhithe.

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No. CCXXXII.

RECENT PATENTS.

To William Joseph Horsfall *and* Thomas James, *both of the Mersey Steel and Iron Works, Toxteth Park, Liverpool, in the county of Lancaster, for improvements in the rolling of iron and other metals.*—[Sealed 19th March, 1850.]

This invention refers principally to the rolling of iron for the manufacture of tyres of wheels and for other purposes; but other ductile metals may be similarly rolled, if thought desirable.

In manufacturing tyres for wheels, according to the ordinary method, the iron, to form a tyre, is heated and submitted to the roughing-rolls, to bring it to shape; it is then passed successively through the several grooves of the finishing-rolls, until it is brought down to the required size, when it is passed out of the rolls as a straight flat bar of iron,—which, when its ends are welded together, will form a cylindrical hoop. But, as tyres of wheels have frequently to fit a chamfered or bevilled periphery, it is necessary, in such cases, to submit the cylindrical hoops, thus formed, to a tedious and costly process of hammering, in order to bring them to the requisite sectional figure for forming a wheel-tyre. Now, the object of this invention, so far as it refers to the rolling of metals for the manufacture of tyres for wheels, is to obviate the necessity for hammering the metal, after it has left the rollers, to bring it to a conical instead of a cylindrical shape when welded into a hoop. This object is effected by the employment of a peculiar construction of finishing-rolls, which will roll the metal

into flat curved strips, instead of into straight lengths; so that, when formed into tyres, these tyres will, of necessity, fit the bevilled periphery of the wheels to which they are intended to be applied.

In carrying out the invention, the patentees take a pile or bloom of iron of any description, according to the quality required, and submit it, in a heated state, to roughing-rolls, to bring it down to a shape nearly approaching that of the first groove in the finishing-rolls; and, when thus prepared, they subject the iron (still hot) to the action of an improved construction of finishing-rolls, shewn in Plate X.; fig. 1, being a front view and fig. 2, a plan view of the same. For the manufacture of a tyre, the heated bar is first passed between the rolling surfaces *a, a*; which surfaces are disposed so as to form an angle to each other,—the design being to roll the metal to unequal thicknesses at its opposite edges. When it has been thus acted upon, it is immediately passed between the rolling surfaces *b*, which are parallel to each other, and its sectional diameter is thereby reduced; after which it is passed between the rolling surfaces *c*, also parallel to each other; and the bar is then made to assume the curved shape shewn at fig. 2. While yet in a heated state, the bar or rolled strip is carried to the machine shewn in plan view at fig. 3, where it is bent round into the form of a conical hoop, which may then be welded, and the tyre is complete.

This machine consists of a circular frame or table *a*, mounted on a central shaft *b*, which is properly supported in a vertical position. The shaft *b*, with its table, is rotated by a bevil-wheel, connected with any suitable motive power machinery, taking into a similar wheel, keyed on to the shaft *b*. The table *a*, is provided with a series of radial slots, which form guides for a series of adjustable stop-pieces *f*, capable of being fixed, in any required position, by means of bolts (as shewn in the drawing), so that they will hold firmly a ring *g*, of any required diameter, which forms a sort of core, round which the strip of heated metal is to be lapped to form a tyre. Between this ring and the lug of the sliding stop-piece *f**, one end of the heated strip of rolled metal is secured by a wedge,—the stop *f**, having previously been brought round in front of the fixed guide *h*, which is intended to guide the strip on to the frame or table *a*. Mounted in a sliding frame *i*, is a pressing-roller *k*, which is brought into contact with the heated bar or strip of metal, for the purpose of causing it, when the table *a*, is rotated in the direction of the arrow, to lap round the ring *g*, and thereby form a hoop. The contact of the

roller *k*, with the heated strip, is effected by means of a hand-lever *l*, which has its fulcrum on the fixed guide *m*, (in which the guide-rod of the frame *i*, slides) and is also connected to that frame by a pin of the lever dropping into one of a series of slot-holes made in the upper edge of the guide-rod. During the operation of bending a strip of metal into a hoop, the lever *l*, is held in the position shewn at fig. 3, to keep the roller *k*, up to its work; and when the strip of metal has been lapped round the ring *g*, the roller *k*, is drawn back, the wedge at *f**, is knocked away, and the hoop, thus formed, is removed from the table. It is then ready for welding; and when it has undergone this operation, a tyre will be constructed of the form required,—the inner face being conical and suitable for fitting the bevilled or chamfered periphery of a cart-wheel. It is obvious that hoops for tyres of various diameters may be made by increasing or diminishing the length of the strip of metal, and by shifting the stop-pieces *f*, of the table *a*, nearer to or further from the centre, to allow of their holding a ring *g*, of a lesser or greater diameter, corresponding to the size of the wheels which are to receive the tyres; and also that the difference of angle between the rolling surfaces, which produce the varied sectional thickness of the rolled bars, must be determined by the amount of bevil of the periphery of the wheels to which the tyres, formed from the rolled bars, are intended to be applied.

The patentees remark, that instead of subjecting the bar to the action of the bending-machine, above described, or to other similar apparatus, it may be allowed to remain in the form produced by the operation of their improved finishing-rollers; in which state it may be applied to any purposes where a flat ring or hoop of metal is required: for instance, the curve produced may constitute a ring, suitable for the shrouding or ring of a paddle or water-power wheel,—the necessary diameter being acquired by suitably adjusting the angle of the rolling surfaces, as before mentioned.

This method of rolling metals may be also employed for rolling zinc, and other like metals, into thin sheets or lengths, forming the segment of a circle; and which, when divided by lines radiating from the centre of that circle, and cut into pieces at those lines, may be formed into conical pipes and vessels, with little or no scrap-waste occurring in the manufacture.

The patentees claim the rolling of iron and other metals (which it may be desirable to submit to the improved rolling operation) into bars or strips and sheets, by first passing the

metal, under operation, between rolling surfaces which are set at an angle to each other, and afterwards submitting such metal to rolling surfaces which are parallel to each other, whereby the advantages, hereinbefore described, may be obtained.—[*Inrolled September*, 1850.]

To Alfred Vincent Newton, *of the Office for Patents*, 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for an invention of improvements in the production of gases, to be used for lighting, heating, and motive power purposes,—being a foreign communication.*—[Sealed 12th June, 1850.]

This invention, which has recently been the subject of much comment, both in this country and in the United States, under the title of "Mr. Pain's discovery," mainly consists in certain improvements in magneto-electrical apparatus, for decomposing water or other fluids, in order that the gases evolved therefrom may be applied to various useful purposes.

The improvements effected in the construction of magneto-electrical machines are intended to increase the decomposing power of the electric current, and cause it to act with great effect upon the fluid it is intended to resolve into its elements. Adhering generally to the ordinary form of the helices, the inventor substitutes for the common helical coil a coil of tubing, made of copper or other good conducting metal; and this he fills at pleasure with water or other electrical absorbent. The object of this arrangement is not merely to obtain an increased surface for the electrical currents (by reason of the inner and outer surfaces of the coils being conductors), but also to accumulate electricity,—the water or other absorbent taking up the excess during each revolution of the helices, and retaining the same till relieved by the action of the dischargers, as hereinafter explained. These tubular coils may be made of some metal that will not easily corrode or oxidate,—the same being insulated externally; or they may be made of some non-conducting substance (such as gutta-percha tubing), filled with the liquid, and a metallic conducting-wire inserted therein. It has been found that electricity, when applied in a continuous or unintermitting current, cannot be used successfully as an agent for decomposing water or other fluid in sufficient quantities and at a cost that will allow of the application of the products to general purposes; but, by causing the electric current to enter the water in a series of discharges

or pulsations, large volumes of gases may be evolved, and at a moderate cost. These improvements admit, not only of the discharge of the electric fluid in such pulsations, but of the accumulation to any required extent between any two pulsations or discharges.

In order to prevent the injurious effects of too great intensity in the electric current, and to ensure a safe and continuous action, the inventor passes the current of electricity (obtained from the electro-magnetic apparatus hereafter to be described, or any other suitable arrangement of electro-magnetic apparatus) through an improved arrangement of governor, which, when the current of electricity is too intense, will cause it to be discharged into the earth, instead of being allowed to pass to the electrodes.

This invention also includes some improvements in the construction of electrodes, which will be fully described hereafter.

In Plate XI., at figs. 1, 3, and 4, A, A, are two helices, the interiors or cores *c*, of which are formed of soft iron (or they may consist of tubing, filled with water); and *t*, *t*, are the coils of the helices, also filled with water. These coils *t*, *t*, are wound round the cores *c*; and they are connected together, as at *k*, fig. 3. The revolution of the helices is effected by clockwork, or other simple motive power; and they are mounted so as to turn between the poles of a pair of permanent magnets B, B, upon one common spindle C. On the head of the spindle is an insulating cap D, carrying two metallic rings, one placed around its vertical edge E, and the other around its top E^1,—each being insulated from the other. The termini F, F, of the helical coils are attached one to each ring E, E^1. (The small rod that connects the discharging-rings E, E^1, on the spindle-head D, with the hollow helical coils, should be split its entire length, in order that, when it enters the hollow coil, it may convey the fluid up towards the ring, and allow the electricity to enter the water). Now, instead of having friction-dischargers pressing against these rings, the dischargers are made as follows:—A wheel G, of the required diameter, with its periphery covered with some good non-conducting substance, except at one point H, (which must be a good conductor), is made to press, by means of a spring-arm I, against the ring E, on the spindle-head;—the stud K, which supports the spring-arm, being insulated; and the conducting-wires J, starting from the arm I. By this arrangement, no discharge from the helices can take place until the non-insulated point H, on the discharging-wheel, comes in

contact with the ring E; and, consequently, according to the relative proportions in the diameters of the ring and the wheels, so will the amount of accumulation between the dischargers be.

One of the improved arrangements of electrode is shewn, in connection with the electro-magnetic apparatus, at fig. 3, and in sectional elevation, on an enlarged scale and detached from the machine, at fig. 5. In this arrangement, the negative wire of platinum *n*, is soldered, at one end, to one of the conductors *i*, *i*, and its other end is wound into a coil, making a cylinder of any convenient size; into which coil the positive wire *p*, (connected by soldering to the other conductor *i*,) is inserted;—the lower end of this wire *p*, is soldered to a metallic button at the lower end of the negative coil. This arrangement may be reversed when opposite effects are desired. The electrode is enclosed in a cylindrical casing *f*, being a non-conductor; the upper end of which is pierced with numerous small holes, to allow of the escape of the gases evolved; and its bottom has an aperture of about one-sixth of the diameter of the case, to allow of water entering therein from the tank or vessel in which it is immersed.

Another arrangement of electrodes is constructed in the following manner:—The negative pole is attached to the inner side or top of the cell or casing. The positive pole passes down into the cell to about one-third its depth, and terminates in a horizontal plate of copper or other good conducting metal. From this plate a number of platinum wires or points extend downwards into the centre of a corresponding number of coils, also of platinum, which are attached to the bottom of the cell or casing. In this arrangement (as well as in the one last described) the exterior of each coil must be covered with a non-conducting substance; and so in like manner must the surfaces of the cell or casing be coated.

Another arrangement of electrode is shewn in plan and sectional elevation at figs. 6. This electrode is constructed upon the principle of conveying the currents on large free conductors, terminating in a great number of radial points 1, 1,—the negative pole 2, or pole-points, radiating from a common centre around and along the conductor's terminus, and the positive pole-points 3, converging from the interior of a cylinder or cell 4, to which the positive conductor 3, is attached; and so, *vice versâ*, when the positive pole enters the cell and the negative is attached to its interior. The casing of the electrode must be made a non-conductor on its outer surface, by applying to it a coating of sealing-wax, or

other insulating substance. The top of the casing 5, is pierced with numerous small holes, and its bottom 6, with an aperture of about one-sixth its diameter. The conductors should be insulated, so as not to come in contact with the water at any time or place. This may be effected either by passing them through glass tubes, or by coating them with some non-conducting substance. Copper or other metallic cells or casings may be used; but the electrodes and the radial points are preferred to be of fine platinum. The points on the interior of the cell or cylinder may be dispensed with, and the central or radial points of the electrode be made to come nearly in contact with the cylinder's surface; but practice has proved that this arrangement is not so good as the double sets of points.

In decomposing water, the cell or casing, with the electrodes properly arranged and attached, is plunged into a tank or vessel, of convenient shape, filled with water.

The effect of these arrangements of electrodes is to isolate, as it were, a certain quantity of water in the casing or coil, and to bring to bear upon it, by a series of pulsations or intermittent discharges, the accumulated force of the electric fluid, and thus evolve the gases with extraordinary rapidity. The water to be operated upon should be distilled or boiled, in order to get rid of the atmospheric air which it generally contains.

It appears that a given quantity or force of the electric fluid is required to decompose water; and that any excess interferes with its decomposing power, and causes a repulsive action of the electrodes,—subjecting them to injurious action. In order to guard against this difficulty, the electric current is passed to a governor, as before mentioned, previous to conducting it to the electrode. The construction of this governor, which is shewn in sectional elevation, in connection with an electro-magnetic apparatus, at fig. 3, will be readily understood from the following description thereof:—The conductors J, from the electro-magnetic apparatus, are connected with the helices around an electro-magnet N, and then pass along a conductor O, to the insulated mercurial cylinder P. A platinum bar Q, pendent from the end of a balance-beam R, dips into the mercury of this cylinder; and at the opposite end of the balance-beam a similar platinum bar and mercurial cylinder, Q^1, and P^1, are provided. From the cylinder P^1, proceeds the conductor T, to the electrodes in the water or other fluid to be decomposed. Attached to the beam R, directly above the poles of the electro-magnet N, is an armature W. Taking advantage of the well-known law, that the

more intense the current passing around the legs of an electro-magnet, the greater the power—it is readily perceived, that, as all currents, passed into the fluid to be decomposed, are first made to pass around the electro-magnet N, there is, consequently, a continued force acting on the beam R, through the armature W. The action of this force may be easily graduated and governed, by placing a spring S, so as to act on the beam on the opposite side of its fulcrum to that on which the armature is placed. Now, if the beam be so adjusted that, when the proper decomposing action is obtained, the spring balances the power of the magnet while a current of the ordinary intensity is passing through the coil, it will be evident that, when the intensity increases, the power of the magnet will overcome that of the spring, and that end of the beam which carries the platinum bar Q, will be drawn down, and, consequently, the platinum bar Q^1, will be raised out of contact with the mercury in the cylinder P^1, whereby the connection with the electrode will be broken. It has been sometimes found that, when the current is suddenly broken by drawing out the bar in the cylinder P^1, a vacuum, or partial vacuum, is formed; into which the mercury rises, and, consequently, the metal is spilt,—a result which terminates the action of the machine until the mercury is replaced. To avoid this difficulty, an auxiliary cylinder Z, is placed under the beam, between the conducting cylinder P, and the electro-magnet N. This cylinder is filled with mercury like the other, and into it a platinum bar X, attached to the beam R, dips, in manner similar to the other bars. The mercury is gauged in this cylinder, so that the bar shall enter the mercury before the bar Q^1, leaves its bath; and, by this means, the current is turned into the cylinder Z, and thence passes off into the earth, or to a reservoir of water, by means of the conductor *a*.

To render hydrogen gas, obtained by the decomposition of water, suitable for the purposes of illumination, it is passed through spirits of turpentine, or any other suitable fluid hydrocarbon. The chief matter to be attended to in this operation is to prolong, to the proper extent, the passage of the gas through the hydrocarbon; as a given time is necessary, in order that the hydrogen may become effectually endowed with the luminiferous property: the inventor, therefore, employs a means of retarding the passage of the current, whereby it is made to bubble through the liquid. The method preferred is to attach cotton wick, or the hollow wick of an argand burner, or some such substances, to the end of the gas tube that dips into the turpentine, or to perforate the end of the tube with

numerous small holes; and, by passing the gas through the interstices of the fabric, or the pierced tube, to cause it to divide into minute globules. By this means a greater amount of frictional contact is obtained between the hydrocarbon and the gas. It is stated that when the pipes, which lead from the decomposing tank to the hydrocarbon, are made of non-conducting materials, or are coated on their interior with sealing-wax, or other insulating substance, the effect is the most brilliant. The hydrogen should, therefore, be conveyed by means of such tubes from the decomposing cells, and passed with all possible speed into the hydrocarbon; after which it may be collected in gasometers or other reservoirs. These latter may also be insulated by position, or by the use of insulating materials; and, in practice, it may be found highly advantageous to use pipes and tubes of non-conducting materials to convey the gas to the points of consumption. It deserves also to be borne in mind, that the vessel containing the turpentine or other hydrocarbon, should be of some non-conducting substance; since it appears to be essential to the complete luminiferating or catalysing of the hydrogen, that it should come in contact with the hydrocarbon whilst in a highly-electrified state. The height of the column of the hydrocarbon should be nearly equal to that of the column of water around the gasometer, to prevent the hydrogen from passing too rapidly through.

The following is a description of what the inventor terms his magneto-electric decomposer.

Fig. 1, represents the machine in horizontal section: it contains three sets of horse-shoe magnets, of which the three lower ones are shewn resting on the frame, with their respective helices. Fig. 2, shews the three upper magnets, and also the three pairs of discharging-wheels, in their relative positions, with the spring, arms, studs, &c., by which they are supported. Fig. 3, is a vertical section of a part of the supporting-frame, of one pair of magnets, one pair of helices, one pair of insulated rings on the head of the helix spindle, of one pair of discharging-wheels, of the governor or regulator, the decomposing-jar or tank, with an electrode immersed therein; also shewing the different conductors, and the manner of insulating the different parts: the other figures, which have been already referred to, shew, in detail, some of the most important parts of the machine.

By means of a weight, or spring, or other convenient power, motion is given to a train of geared wheels, which, in their turn, cause the helices to revolve between the poles of the

magnets. These magnets need not be permanent; but, if not, should be inducted immediately before putting the machine in action. The discharging-wheels being of much larger diameter than the rings on the spindle-head, the helices necessarily revolve several times before a discharge can take place. The electricity is consequently accumulated in the helices, and passes off with proportionate intensity at the periodic times. The conducting-wires should be of the best conducting material, and of large surface; and, in operating upon a great scale, they are made tubular, and filled with water, as before mentioned. The cells and coils are important parts of the arrangement; and, in their construction, the conditions above mentioned should be well observed.

Throughout the foregoing specification, water has been spoken of as being decomposed by the electric currents; but it is desired to be understood, that this has been done merely in accordance with the generally-received chemical doctrines and phraseology. It is suggested that water may be found to be a simple element; but whether or not, all that is desired to be laid down as certain is the fact that, by discharging electricity through water, in the modes above described, large quantities of gases are evolved; and that one at least of the gases so evolved, when passed through spirits of turpentine by the means above explained, becomes highly luminiferous.

The patentee claims, First,—the use of helices, furnished with hollow helical coils or tubes, to be filled, at pleasure, with water or other electrical absorbent. Secondly,—the construction and use of electrodes, as above described. Thirdly,—applying electricity to the decomposition of fluids by pulsations or intermittent discharges. Fourthly,—the construction and use of the governor, for regulating the electric currents, as above described. Fifthly,—the mode of catalysing or rendering hydrogen gas luminiferous, by passing it through spirits of turpentine or other hydrocarbon, at common temperatures. Sixthly,—the use of non-conducting pipes and insulated gasometers for conveying and receiving the gases for the purposes of this invention.—[*Inrolled December*, 1850.]

To JOSEPH FOOT, *of Spital-square, in the county of Middlesex, for improvements in bolters.*—[Scaled 27th June, 1850.]

THIS invention relates to the apparatus commonly used for dressing flour, and known by the name of bolters. The pa-

tentee states that the cylinders of such machines have been heretofore made of fabrics composed of yarns of wool; but such yarns have numerous fibres projecting therefrom, which tend to obstruct the meshes of the fabric and impede the operation of bolting; and he therefore proposes to use silk in the manufacture of bolters—whereby the operation of bolting will be facilitated, and the product of flour increased.

The patentee prefers to use Italian silk, thrown in the manner of organzine, but with more twist, so as to make the same as wiry as possible; and he weaves the same into a fabric of a tubular form, in the manner well understood. In order that the tubular fabrics, thus made, may be larger at one end than at the other (as is generally preferred for bolters), the work is moistened with water from a sponge, applied from time to time thereto between the reed and the breast-roll; and, in winding up the fabric, the weaver adjusts the work to the required width, which it will retain when dry. The fabrics are then completed by attaching the ordinary head and tail leathers thereto. Although these fabrics are made by using silk alone for both the warp and weft, yet yarn made of wool may be used in combination with silk, particularly as weft.

The patentee claims, as his invention, the employment of silk in the manufacture of bolters.—[*Inrolled December*, 1850.]

To William Dick, *of the City of Edinburgh, professor of veterinary medicine in the Edinburgh Veterinary College, for improvements in the manufacture of steel and gas.*—[Sealed 22nd August, 1850.]

This invention consists in making steel and gas in the same retorts or furnaces at one and the same time.

In carrying out this invention, the patentee employs the common fire-clay gas retorts. When the retort is heated to the temperature required for the production of gas, the iron that is to be converted into steel (and which is preferred to be in bars of a similar length to the retort) is introduced and laid horizontally upon a thin layer of coke in the lower part thereof. The retort is then charged with coal or other suitable material for making gas; and the operation of manufacturing gas is conducted in the ordinary manner;—the retort being charged with fresh quantities of coal or other material at the usual intervals of time; and the bars of iron remaining in the retort for a longer or shorter period, according to their size or thickness, and being turned over at intervals of two or three

days, at the time when the retort is charged with fresh supplies of coal or other material. The bars are allowed to remain in the retort until the process of cementation is completed, and they have been converted into steel. The progress of the operation of converting the iron into steel is tested from time to time, by suddenly cooling one of the bars and breaking it; and the operation is continued until the disappearance of the "pith" in the centre indicates the completion of the process of cementation.

The patentee states, that he does not claim the conversion of iron into steel by the action of carburetted hydrogen gas on iron shut up along with the gas; but what he claims is, the process of making steel and gas in the same retorts or furnaces, at one and the same time.—[*Inrolled February,* 1851.]

To JOHN SAUL, *of Manchester, cotton-spinner, for certain improvements in machinery or apparatus for spinning and twisting cotton and other fibrous substances.*—[Sealed 5th September, 1850.]

THE machines for spinning and twisting fibrous substances, referred to in the title of this patent, are those known by the name of throstle-frames. The invention relates to that particular construction or arrangement of the spindle and flyer which formed the subject of a patent granted to Henry Gore, December 22, 1831*; and it consists in the application of a loose tube between the fixed or steadying-tube (described in Gore's specification) and the bobbin; whereby the lower bush of the bobbin is prevented from coming into contact with the fixed or steadying-tube; and the friction, which has heretofore taken place between the lower bush of the bobbin and the fixed tube, is transferred to the loose tube, and may be regulated by the application of cloth, leather, or other washers, above and below a flange or collar formed at the bottom of the loose tube;—such flange or collar having about the same diameter as the bottom of the bobbin, and being turned either flat, rounded, or dished, as may be most suitable for the work to be performed. The amount of friction to which the bobbins are subjected, being by this means considerably reduced, their durability will be increased, and much higher numbers or finer qualities of yarn may be spun or doubled than could

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* For description of this invention see Vol. III. of our present Series, p. 142.

heretofore be produced on this description of spinning or doubling frame. The bobbins may be constructed either with or without metal bushes. In spinning fine numbers, when a high velocity is required, it is desirable to attach a fly-wheel to each throstle-frame, in order to prevent the same from being stopped or started too rapidly, and thus to obviate the over-running of the bobbins.

In Plate X., fig. 1, is a sectional elevation of a spindle and its appendages, shewing a loose tube applied thereto, according to this invention; and fig. 2, is an external view of the loose tube. *a*, is the spindle; *b*, the flyer; *c*, the copping-rail; *d*, the bobbin; *e*, the fixed or steadying tube; *f*, the loose tube, with a flange or collar *g*, at the lower part thereof; and *h*, *h*, are washers of cloth, leather, or other suitable material, interposed between the bottom of the bobbin and the flange *g*, and between this flange and the flange at the bottom of the tube *e*.

The patentee claims the application, employment, or use of a loose tube betwixt the ordinary fixed (or "Gore's") tube and the bobbins in the aforesaid description of machines, in the manner and for the purpose above particularly set forth, and as represented at *f*, *f*, *g*, *g*, in the drawings annexed.—[*Inrolled March*, 1851.]

To William Edward Newton, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for an invention of improvements in the construction of ships' magazines,—being a communication from abroad.*—[Sealed 22nd August, 1850.]

This invention relates to improvements in gunpowder magazines for ships,—the object being to protect them from the action of fire, either in the time of battle, or from accidental conflagration.

Attached to the magazine are certain pipes, which lead to and terminate at the sides of the ship,—through which openings are made to allow of water flowing into the pipes. These pipes are provided with valves or cocks, by turning which water may be allowed to flow into the magazine and fill it, if required.

The invention consists, firstly, in the adaptation, to the said cocks and pipes, of an apparatus, which is of such nature that the presence of heat, arising from combustion, will cause the cocks or valves to open, and allow of the flooding of the

magazine with water long before fire shall actually come in contact with the magazine, and thereby save the ship from the effect of an explosion.

The invention consists, secondly, in applying to the improved magazines a certain contrivance for entering and leaving the same, and removing the powder therefrom, if necessary, while the ship itself may be on fire.

In Plate XII., fig. 1, is a side elevation, shewing so much of the magazine as is necessary to exhibit the manner of attaching the pipes and the apparatus connected therewith; and fig. 2, is a plan view of this apparatus detached. The magazine should be composed of sheet-metal, and be made water-tight. In the side of the magazine there is inserted the usual lens for lighting the interior; and at the bottom there is also a cock, of common construction, for discharging the water after the operation of flooding has been performed. *c, d,* are the flooding-pipes, which, it will be seen, are placed in different parts of the magazine. *c,* enters the magazine near the top, and its opposite end terminates at the side of the vessel; while *d,* is connected with the magazine at or near the bottom, and passes out at the bottom of the vessel. The object of this is to produce a circulation of water in the magazine by a well-known law, whereby heat, acting on fluids in certain places, causes a change in the specific gravity of the parts thereof; so that the equilibrium of the mass being disturbed, the rarefied parts seek their proper level. Thus, if the magazine *a,* is full of water, and heat is applied externally, it would soon change the gravity of a portion of the fluid, so that a current would be produced, which would flow outward through the pipe *c,* and inwards through the pipe *d.* Thus a complete circulation is produced in the magazine, by which any material increase of the temperature of the water is prevented. *e, f,* are stop-cocks on the pipes *c,* and *d,* to cut off or admit the water for flooding the magazine. These are connected together by a rod *g,* so that they may be opened simultaneously. *h,* is a weight, fixed to the rod *g,* in order to give it a tendency to fall and open the cocks *e,* and *f.* The rod *g,* is retained in its elevated position (at which time the cocks are closed) by the apparatus shewn at *i, k, l.* It consists of a rod and spiral spring;—the spring being attached, at one end, to the magazine at *l,* and, at its opposite end *i,* to the connecting-rod *g.* This spring is of sufficient power to support the weight *h,* and keep the rod *g,* elevated, and the cocks consequently closed. A portion of this rod, as at *k,* is made of some substance which will yield—that is, melt, give

way, or expand, by the action of a moderate degree of heat, without coming in direct contact with fire; and, for this purpose, the article known as *gutta-percha* is preferred; as that substance is known to possess the quality of being easily softened and rendered quite plastic at comparatively low temperatures.

The operation of this part of the invention is as follows:—Suppose the hold of a ship to be on fire,—the moment the temperature of the air surrounding the magazine becomes sufficiently high to soften the gutta-percha bar *k*, so that it will no longer have the strength to overcome the tension caused by the weighted rod *g*, and spring *l*, the weighted rod *g*, will fall, and immediately open the cocks and flood the magazine with water. At *m*, is a rod, connecting the two cocks *e*, *f*, by additional handles or levers on their plugs. The length of this rod is such that it may extend up through the deck, and thus afford means of flooding the magazine at any moment by hand from above.

The means of entering or leaving the magazine, without exposing the interior thereof to danger from fire, is shewn in vertical section at fig. 3, and in horizontal section at figs. 4, and 5. The apparatus consists of two cylinders, the one fitted closely within the other, but so that the inner one may revolve; for this purpose it plays upon a centre or pivot *e*, projecting through the bottom of the outer cylinder. In the side of each cylinder a door is cut, as at *a*, *b*, figs. 4, and 5; the inner cylinder terminates in a cap *m*, with a ring or handle affixed to it; and both the outer and the inner cylinders have closed or solid bottoms. A hole is made in the top of the magazine to receive the cylinders, as combined together, and shewn by the dotted lines in fig. 1:—the plate of the magazine, around the hole, has a packing ring *o*, *o*, fig. 3.

When it is required to bring this part of the invention into use, the cylinders are drawn out by the ring in the cap *m*, until the bottom of the outer cylinder shall be above the level of the top of the magazine. Next, the inner one is turned, until the opening or door *b*, made in its side, comes opposite to the opening *a*, in the outer cylinder, as shewn at fig. 5. The person to be sent into the magazine now enters the inner cylinder, which is again turned until *b*, is passed around to the opposite side, and thus the door *a*, is closed, as shewn at fig. 4. The cylinders are now lowered into the magazine, until the flange edge of the cap *m*, rests upon the top of the magazine. The inner cylinder is revolved once more, until the doors are again opposite, when the party can quit the

cylinder and go to any part of the magazine, and then return with powder, and be raised from the magazine.

The patentee claims the attaching of a connecting-piece, made of some easily melting or fusible material, to, and combining the same with, the governing-cocks of the ejection and injection-pipes employed for keeping a circulation of cold water through magazines, or for flooding the same when required,—such connecting-piece being made of such materials, and adapted to the magazine or governing-cocks connected therewith, in such a manner as to be affected by heat without necessarily coming in contact with fire;—this connecting-piece being also governed by a spring, and being capable, when acted on by heat, of liberating certain other parts, which will open cocks and flood the magazine. He also claims attaching and combining with the magazine a double tube or cylinder, or equivalent arrangement, by which articles may be conveyed into or from the magazine without in any way exposing the interior of the magazine to fire from without;—by which several arrangements, a perfect security is effected against firing the magazines of vessels of war.—[*Inrolled February,* 1851.]

To Astley Paston Price, *of Margate, in the county of Kent, chemist, and* James Heywood Whitehead, *of the Royal George Mills, Saddleworth, near Manchester, for improvements in filters.*—[Sealed 12th September, 1850.]

This invention consists, firstly, in making filters by drawing a tubular fabric into itself; secondly, in making filters by drawing one tubular fabric into another, in such manner that filtration shall take place inwards as well as outwards, and combining them with an external case or sheath (of smaller diameter than the tubular fabrics), and with nozzles at each end; thirdly, in making filters by combining a filter-bag, drawn within itself, with a supply tube and an external sheath or case of smaller diameter; and fourthly, in manufacturing filters of certain kinds of fabrics hereafter described.

In Plate XI., fig. 1, is a vertical section, and fig. 2, an external view of a filter made according to the first part of this invention. It consists of a tube *a, b,* made of any suitable fabric,—the part *b,* of which, is drawn within the part *a*; the ends of the tubular fabric are secured to a nozzle or supply-tube *c*; and then the filter is inserted into a sheath or case of netting *d,* which is of less diameter than the tube *a, b,* so that it will cause the formation of folds in the direction of

the length of the fabric, and thus produce a greater extent of filtering surface in a given space. The fluid to be filtered enters through the supply-tube *c*, into the annular space formed by drawing the part *b*, into the part *a*; and then it not only filters outwards through the interstices of the part *a*, but also inwards through the part *b*, into the central space *c*, from which it escapes at the bottom thereof. In order to cleanse this filter, it must first be withdrawn from its sheath or case *d*; and then the tube *a*, *b*, must be disengaged from the supply-tube *c*, and drawn out to its full length, in such manner that the surface retaining the sediment will become the outer surface, and may therefore be readily cleansed.

Fig. 3, is a vertical section of a filter, constructed according to the second part of this invention, by drawing a tubular fabric *b*, into another tubular fabric *a*, and attaching the ends of such tubes to a supply-tube or nozzle *c*, at the top, and to a discharge-tube or nozzle c^1, at the bottom. The fluid (as in the filter previously described) filters outwards through the fabric *a*, and inwards through the fabric *b*, into the space *e*, from which it escapes through the tube or nozzle c^1. To cleanse this filter, it is withdrawn from its sheath or case of netting; the tubes *a*, and *b*, are detached from the supply-tube *c*; and then the inner tube *b*, with the nozzle or tube c^1, is drawn through the tube *a*, so as to turn the inner surface of such tube *a*, outwards: by this means, the whole of the sediment will be brought to the outer surface of the tubes *a*, and *b*, and can be easily removed.

Fig. 4, is an external elevation, and fig. 5, is a vertical section of the third kind of filter, which is produced by drawing a filter-bag *f*, within itself, securing the ends of the bag to a supply-tube *c*, and enclosing the bag in a sheath or case of netting of smaller diameter than such bag. The patentees state, that they are aware that several years ago a Mr. Schroeder obtained letters patent for a mode of constructing filters, which consisted in drawing a long bag within an external sheath or case of considerably smaller diameter than the bag; and this part of their invention is similar thereto, inasmuch as the bag is drawn within a case of smaller diameter, but it differs therefrom in that the bag is drawn within itself: in consequence whereof, filters made according to this third part of their invention offer a similar extent of surface to a Schroeder's bag, but occupy, longitudinally, only half the space.

The last part of the invention consists in making filter-bags of fabrics composed of a combination of cotton yarn and woollen or worsted yarn—of yarn consisting of a mixture of

flax and cotton, carded and spun together—of such yarn, consisting of a mixture of flax and cotton, and woollen or worsted yarn—of yarn formed of wool and cotton, carded and spun together—and of yarn made of flax and wool, or of cotton, flax, and wool, carded and spun together. The patentees state, that they believe that the best method of making the fabrics is to weave the same twilled, as filter-cloths have heretofore been made of cotton yarn; and the same may be woven in a circular or tubular form, as is well understood. In carrying out this part of the invention, the warp may be made of cotton, and the weft of woollen or worsted yarn, or *vice versâ*. Or the warp may be made of cotton and flax, carded and spun together (by preference, in equal quantities), and the weft of woollen or worsted yarn; but this may be reversed. Or the fabric may be made entirely of yarn, composed of the mixture of cotton and flax, carded and spun together: for this purpose, the patentees prefer to use these materials in equal proportions; but they do not confine themselves thereto. Or the fabric may be manufactured wholly or partially of yarn, composed of cotton and wool, carded and spun together in the proportion of two of the former to one of the latter: these proportions are considered by the patentees to be the best; but they do not confine themselves thereto. Or the fabric may be made wholly or partially of yarn, composed of flax and wool, or of cotton, flax, and wool, carded and spun together in about equal proportions.

The patentees claim, First,—the making of filters by drawing a tubular fabric into itself, as above described. Secondly,—making filters by drawing one tubular fabric into another, and combining them with an external sheath or case of smaller diameter, and with parts c, c^1. Thirdly,—making filters by combining a filter-bag, drawn within itself, with a supply-tube c, and an external sheath or case of smaller diameter. Fourthly,—the manufacture of filters of the fabrics above described.—[*Inrolled March*, 1851.]

To Robert Longdon, *the younger, of Derby, glove manufacturer, and* Thomas Parker Tabberer, *of Derby, aforesaid, manufacturer of elastic fabrics, for improvements in the manufacture of looped fabrics.*—[Sealed 12th September, 1850.]

This invention consists, firstly, in a mode of narrowing or shaping knitted fabrics while in course of manufacture in

knitting-machines. To effect this, it is usual to employ, at the selvages or edges of the work, what are termed "tickling-points," of which four or five are generally used at each selvage where the narrowing or shaping is to take place; and, in making the ends of the fingers of gloves and similar work, the work at the end of each finger has to be divided and made into two scolloped pieces, which require separate pieces of thread to be laid on by hand,—the thread-carrier, which lays on the thread for making the other part of the finger, being put out of action, or only used for laying the thread for one of the two divided ends. Now, the patentees propose to narrow or shape the work by using a larger number of tickling-points, and by carrying the work back, not only at the selvages or edges, but also at the interior of the work: whereby they render it unnecessary to divide the ends of those parts of the work which are to form the fingers of gloves, &c.

In carrying out this part of the invention, the ticklers are used in two rows; and those points which are to work at the selvages or edges (being five at each selvage) are bent down into a lower row than the others, so that they may be used without bringing the others into action. The operation of narrowing or shaping is conducted as follows:—The action of the knitting-machine having proceeded in the usual manner until the narrowing or shaping is to take place, and the course being worked in the ordinary way, the lower or selvage-ticklers are brought down on to their needles, and the loops are shifted in the usual manner. In the next shaping of the loops, all the tickling-points come into action,—the selvage-points bending down their needles for a distance equal to the distance between those points and the upper tickling-points, and the upper points coming into action on their needles, and shifting the work therefrom into or towards the centre portion of the work. In such cases as the formation of the ends of the fingers of gloves and other narrow work, when the narrowing has been carried on to some extent, then, in the further working, it will not be desirable to bring the selvage tickling-points into action, and there will be no necessity for dividing or splitting the work at the end of the fingers of gloves. By this means, the operator will be enabled, not only to tickle at the selvages, but also at any part or parts of the body of the work, according to the arrangement of the ticklers.

The second part of the invention relates to the needles used in machines for manufacturing looped fabrics, and consists in a mode of rendering the stems thereof (beyond where the work comes) of greater strength than usual.

Heretofore, in making needles for knitting-machines, the wire has been of the same diameter or substance from end to end, and the flattening of the part of the wire intended to form the stem of the needle, has reduced its strength at that part in a lateral direction. Now, this part of the invention consists in making the needles of wire which is of less diameter or gauge at one end than at the other: the decreased diameter of the wire may be obtained by reducing or removing the metal at the desired part; or by drawing such part of the wire through smaller dies than those through which the remaining portion of the wire is drawn. The patentees prefer to effect the reduction of the wire by chemical action, as follows:—They take a number of pieces of wire, of the proper length for making the needles, and of suitable diameter for forming the stems thereof, and insert such wires into a thin board, with the parts which are to be reduced, in order to form the bearded ends of the needles, projecting downwards. They then immerse such parts in a solution of sulphate of copper, prepared by dissolving one pound of the sulphate of copper in a gallon of distilled water. The lower parts of the wires are kept immersed in the solution until they are sufficiently reduced in diameter; and then they are ready to be made into needles in the ordinary way. The upper parts of the wires are protected from the action of the solution by forming a ledge or rim around the top of the board, and then pouring melted fat into such receptacle around the stems of the needles.

The third part of this invention consists in a mode of making knitted fabrics with fleece or projecting-loops on one side thereof.

Such fabrics have been hitherto made by the employment of double-knibbed sinkers, having one knib lower than the other, so as to produce the projecting loops or fleece by making such loops longer than the others. In the improved mode of manufacturing such fabrics (which constitutes this part of the invention), the ordinary sinkers are used, together with needles alternately having long and short beards; so that at one time the presser may press the loops off all the beards, and at another time only off the beards of every alternate needle; and thereby the loops upon the long bearded needles may be knocked over,—the needles with the short beards receiving and holding the work. In working according to this improved mode, the loops for the body of the work are produced in the ordinary manner. The projecting loops are obtained by laying the thread, drawing the jacks, and lowering the lead-sinkers

in the usual way; then the needles are pressed whilst over the arch, and the work, being brought forward, is pressed off every alternate needle (*i. e.*, every needle with a long beard); and the work is received and held by the needles with the short beards. The working is continued in the usual manner until the next row of projecting loops is to be formed; and then the above operation is repeated. Hitherto, in making like descriptions of fleecy fabrics in knitting-machines, the fleece has been formed on every needle; but, in this case, it is produced on every alternate needle; and a finer and more elastic fabric is obtained.

The fourth part of this invention consists in a mode of manufacturing knitted fabrics ribbed on one side. This is effected by the employment of sinkers having two knibs of a like length, together with needles alternately having long and short beards, and by using two threads of the same or different sizes and of the same or different color of material. The course is worked in the manner usually practised with double-knibbed sinkers, except that the pressing takes place twice in each course—once over the arch and once off the arch. In pressing over the arch, the front loops are pressed off the long bearded needles, and the work is caught by the short bearded needles only. The back thread being brought under the long beards, the frame is then thrown up; in doing which, the back thread is moved behind the short beards; and the course is then worked in the ordinary way. The fabric, thus produced, has ribs or stripes on one side and a satin appearance on the other side.

The fifth part of this invention consists in a mode of manufacturing looped fabrics with India-rubber threads therein.

Heretofore, in such manufacture, it has been the practice either to use the India-rubber threads in a non-elastic state, and to restore the elasticity thereof by heat after the fabric is made,—or else to employ them in an elastic state, but without stretching the same during the process of manufacture; so that the fabric, when made, will not contract to the desired extent. The improvement consists in introducing elastic India-rubber threads, in a stretched state, into the fabric, whilst the same is being manufactured. For this purpose a tubular carrier is employed, as represented in Plate XII., at figs. 1, 2, and 3:—fig. 1, being a plan view and figs. 2, and 3, sectional elevations thereof. *a*, is the carrier; *b*, is a rod, which extends horizontally through holes in the side of the carrier, and has a hole formed through its centre; and *c*, is the India-rubber thread, which passes downwards through the hole

in the rod *b*, and is delivered from the lower end of the carrier. The rod *b*, accompanies the carrier in its movements; and, so long as the hole in it coincides with the central line of the tubular carrier (as in fig. 2,), the India-rubber thread will be delivered freely; but when the hole in the rod is moved to the side of the carrier (as in fig. 3,), the India-rubber thread will be securely retained and prevented from passing through the hole; and, as the carrier continues to move onward, the India-rubber will be stretched to an extent depending upon the distance which the carrier travels before the India-rubber thread is again released. A cord *d*, is attached to each end of the rod *b*, by which the workman is enabled to move it at pleasure, and thus to regulate the degree of stretching to which the India-rubber thread is to be subjected. To prevent the needles from being drawn on one side by the stretching operation, the patentees use pins, as shewn at *e*, in fig. 4, which exhibits some of the working parts of a knitting-machine: the pins are affixed to the rafters, and project upwards between the needles *f*.

The last part of this invention consists in a mode of making the socks or "uppers" of boots.

The sock is formed of knitted fabric, with an elastic band at the top (but the application of this band is not claimed); and the lining is made of brown holland, or similar fabric, in which, at each side, over the ankles, a piece of India-rubber fabric is inserted and stitched thereto;—the object being to obtain additional strength, in combination with elasticity, over the ankles.

The patentees claim, First,—the improvements, above described, in the means of narrowing or shaping knit fabrics. Secondly,—the improvement in needles used in machines employed in the manufacture of looped fabrics. Thirdly,—the mode, above described, of making knitted fabrics with fleece or projecting-loops on one side, produced by the alternate needles. Fourthly,—the mode of making knitted fabrics with a ribbed appearance on one side, by the employment of needles with long and short beards in combination with two-knibbed sinkers. Fifthly,—the mode of making looped fabrics with India-rubber therein, as above described. Sixthly,—the mode of making the socks or uppers of boots, as above described.—[*Inrolled March*, 1851.]

To Rodolphe Helbronner, *of Regent-street, in the county of Middlesex, for improvements in preventing the external air and dust and noise from entering apartments,—being a communication.*—[Sealed 31st July, 1850.]

This invention consists in certain means of making rolls of fabric or fibrous material, and applying the same to fill the spaces between the sashes and frames of windows, the edges and frames of doors, &c., and thus to prevent the entrance of the external air, dust, and noise into apartments.

The apparatus employed by the patentee consists principally of a table, with a hinged flap, and two long wires, extending across the same. Part of the apparatus is represented in Plate X., at figs. 1, 2, and 3;—fig. 1, being a vertical section of the table, taken near one end; fig. 2, a section taken across the centre of the table; and fig. 3, an end view thereof. *a,* is the table, at one end of which a short shaft or spindle is mounted in suitable bearings; and the end of the shaft that is nearest to the table is provided with a disc or boss *b,* to which the two long wires *c, d,* are attached,—the wire *c,* being placed in a line with the centre of the shaft, and the wire *d,* at some distance from such centre. A groove or recess is formed in the table *a,* and in the flap a^1, at the end which is nearest the disc *b,* (see fig. 1,) in order that, when the flap is in the position indicated by dotted lines, the wires may be able to turn freely with the short shaft; and such shaft receives motion, through endless bands, from another shaft, which is turned by a winch-handle. To prepare a roll according to this invention, the edge of a sheet of fibrous material (similar to wadding) is introduced between the wires *c, d,* in the manner represented at fig. 1, and the hinged flap is brought down; the shaft being then caused to rotate, the fibrous material is wound upon the wires as exhibited at fig. 3,—the requisite tension being obtained by the fibrous material passing over the rib *e;* and, when a roll of the desired thickness has been formed upon the wires, the motion of the shaft is stopped, the central wire *c,* is disengaged from the shaft and drawn out, and then the roll is drawn off the wire *d.* The rolls, obtained in this way, are coated with cement, to render the surface uniform and secure the edge of the sheet of fibrous material;—if required, they may be rendered waterproof by the application of a solution of India-rubber or gutta-percha. The rolls may be secured by glue, or other suitable means, in the places where they are to be applied, in order to effect the objects of this invention.

The patentee claims "the means of making rolls suitable for and applying them to prevent external air, dust, and noise entering apartments."—[*Inrolled January,* 1851.]

To THOMAS DICKASON ROTCH, *of Drumlamford House, in the county of Ayr, N. B., Esq., for an improved mode of manufacturing soap.*—[Sealed 31st July, 1850.]

THE improved mode of manufacturing soap, which forms the subject of this invention, consists in introducing certain sulphites, bisulphites, and polysulphites into the fatty and other matters during the process of saponification.

When bisulphite of soda is to be introduced into the mass, during the saponifying process, the ordinary soap pan is used, and the process is conducted in the usual way, by putting in the caustic lyes and fatty or other matter in proper proportions, and heating the mass to the requisite temperature; when the process arrives at this point, an addition is made of twenty parts of bisulphite of soda, dissolved in water, to every thousand parts of fatty or other matter to be saponified; and, after this, the operation is concluded in the ordinary manner, without any alteration being made in consequence of the addition of the bisulphite of soda.

If potash is to be employed instead of soda, it is added to the saponifying mass, in the proportion of twenty-five parts of bisulphite of potash, dissolved in water, to every thousand parts of the fatty or other matter to be converted into soap: in other respects, the operation is conducted in the way usually practised when potashes are used.

When lime is to be introduced into the saponifying mass, twenty parts of bisulphite of lime are added to every thousand parts of fatty or other matter in the soap-pan,—the bisulphite of lime being carefully diluted with water into a kind of milk of lime before it is poured into the mass; and the remainder of the operation is carried on in the ordinary manner.

Another mode of carrying out the invention (which, under some circumstances, may be cheaper and preferable) consists in passing a current of sulphurous acid through the mass of boiling fatty or other matter, during the whole of the ordinary process of saponification, in the proportion of six $\frac{440}{1000}$ parts of sulphurous acid to every thousand parts of fatty or other matter. This is effected by decomposing sulphuric acid in the apparatus represented in Plate X. *a*, is a close vessel or boiler, formed with a flange *b*, which rests on a perforated

plate *c*, set in the brickwork *d*. The cover of the boiler is furnished with a safety-gauge *e*, a feed-pipe *f*, and a leaden pipe *g*, through which the sulphurous acid passes into the lower part of the soap-pan, and then rises through the boiling mass of saponifying matter. About two pounds of charcoal being introduced into the boiler or vessel *a*, with twenty pounds of sulphuric acid at 66° Beaumé, heat is applied (by lighting a fire below the boiler) to effect the decomposition of the sulphuric acid; and such heat is maintained throughout the process of saponification.

In conclusion, the patentee states that sulphites, bisulphites, and polysulphites are equally applicable to the manufacture of soap according to his invention,—the quantity used being varied according as the one or the other is employed. He claims, as his improved mode of manufacturing soap, the introduction of suitable sulphites, bisulphites, and polysulphites, into the saponifying masses of fatty or other matter, as above described.—[*Inrolled January*, 1851.]

To Henri Jeremy Christen, *of Paris, engraver, for improvements in cylinder printing.*—[Sealed 19th September, 1850.]

This invention consists in so printing with cylinders, having the whole of their surfaces engraved, as to leave blank or unprinted spaces on the printed fabrics of any desired shape or design.

The invention is applicable to all descriptions of cylinder printing-machines; and it is carried into effect by placing, at the back of the fabric that is to be printed, a design or pattern, hollow and in relief, which will cause parts of the fabric to be pressed in contact with the engraved surface of the cylinder; whilst other parts of the fabric, where the hollow parts of the pattern are situate, will not be pressed upon, and therefore will not be printed by the engraved cylinder.

The application of this invention to a roller-machine is exhibited by a sectional view in Plate X., where *a*, is an endless fabric, placed at the back of the fabric or cloth to be printed. The length of the endless fabric may be varied according to the design; and the width of it will be regulated by the width of the fabric to be printed. It is made by cementing together four or other suitable number of thicknesses of cotton, or other fabric, by a flexible cement (gutta-percha cement is preferred), and then cementing a surface of woollen fabric

upon the same;—the pattern of the plain part, or the part which is not to be printed, being produced by removing or cutting away parts of the surface of woollen cloth, so that the fabric to be printed will not be pressed in contact with the engraved cylinder at such parts, and they will therefore be left plain. Other suitable materials, which possess sufficient flexibility, may be used for this purpose. It is not essential that the pattern *a*, should be endless; as it may, when desired, be of the same length as the fabric to be printed; or, in place of using a fabric for this purpose, a roller or cylinder may be employed, when the extent of the pattern will admit of it,—hollows being made in the surface of such roller or cylinder at those parts where the engraved cylinder is not intended to print upon the cloth or fabric.

The printing is, in other respects, to be performed in the usual manner.—[*Inrolled March,* 1851.]

To PETER CLAUSSEN, *of Great Charlotte-street, Blackfriars, in the county of Surrey, manufacturer, for certain improvements in bleaching, and in the preparation of materials for spinning and felting, and in yarns and felts,—being partly a communication.*—[Sealed 16th August, 1850.]

THIS invention consists, firstly, in improvements in bleaching all kinds of vegetable productions, and fabrics or articles composed of such productions.

The ordinary process of bleaching fabrics, such as calico, consists in first immersing them in a bleaching liquor (commonly a solution of hypochlorite of lime—the chloride of lime of commerce), and then steeping them in a bath of water acidulated with sulphuric acid: by this means the chlorine is set free in its simple form, or in combination with oxygen (as chlorous or hydrochlorous acid), or in chemical union with the hydrogen of the water (as hydrochloric acid); and thus it is either wasted by escaping, or else, by its remaining too long in contact with the fabrics, the latter are injured. Whereas, in bleaching according to this invention, the whole or a great part of the chlorine or "chloro-compound" is kept in a combined state, and recovered for future use. The patentee states that, by the term "chloro-compound," he does not mean a salt containing chlorine, but an acid having chlorine for its base,—such as chlorous or hypochlorous acid.

In bleaching according to this invention, the goods, after they have passed through the bleaching liquor (say a solution

of hypochlorite of lime), are steeped in a strong solution of some salt whose acid has a greater affinity for lime than hypochlorous acid: thus a strong solution of sulphate of magnesia may be used, the sulphuric acid of which, having a strong affinity for lime, combines with the earthy base of the bleaching salt, and forms sulphate of lime; and the chloro-compound, being thereby liberated, unites with the magnesia and forms hypochlorite of magnesia, which has bleaching properties similar to those of the hypochlorite of lime. This newly-formed compound may, in the next instance, be used as a primary bleaching agent, and be subjected to the process of double decomposition, as in the example just given: thus the goods, after being subjected to the action of a solution of hypochlorite of magnesia, may be steeped in a liquid holding in solution some carbonate or other salt for whose base the hypochlorous acid has a greater affinity than for the magnesia; in which case the carbonic acid (if a carbonate be used), having a great affinity for the magnesia, combines therewith and forms carbonate of magnesia; and the liberated chloro-compound combines with the base of the carbonate employed to produce decomposition and forms a new bleaching salt. This salt may also be employed as a primary bleaching agent, and be subjected to the process of double decomposition with similar results to those above stated: thus if the carbonate used in the preceding example be carbonate of barytes, and a solution of sulphate of magnesia or of lime be brought into contact with the resulting chloro-compound salt of barytes, sulphate of barytes will be precipitated, and the chloro-compound will unite with the magnesia or lime and form a bleaching salt.

In bleaching flax or other like vegetable material for making linen, no compounds should be used which are likely, during the decomposition of the same, to evolve any gaseous matters, such as carbonic acid or chlorine; as, by the development and expansion of the gas in the fibrous tubes, the flax or similar material would be rendered not so fit to be spun by the common flax spinning machinery; but in bleaching flax or similar material which is to be combined with other materials for spinning and felting according to this invention, compounds evolving gas may be safely used, as hereafter explained.

The patentee does not confine himself to the use of the above-mentioned compounds for the purpose of bleaching by the method of double decomposition, nor to any particular salt or class of salts; but he claims a right to use any which, under

the like circumstances, will be subject to the same chemical law of decomposition, and will produce the same result. He however points out, as among the salts suitable for decomposing the chloro-compound salts, or assisting in the process of bleaching, the carbonates (such as carbonate or bicarbonate of soda), sulphates (as sulphate of magnesia), nitrates (as nitrate of soda), acetates (as the acetates of potash and of lead), prussiates (as prussiate of potash), chromates (as chromate and bichromate of potash), and tartrates (as tartrate and bitartrate of potash).

Another method of bleaching, which is especially applicable to goods composed of both animal and vegetable fibres, consists in exposing the goods—after they have been steeped in any of the ordinary bleaching liquors (such as the solution of hypochlorite of lime), and while they are still wet—to the fumes of sulphur, produced by burning the same slowly in a suitable chamber or stove. In this case two powerful bleaching agents are brought into operation, viz., the hypochloritic compound and the sulphurous acid produced by the combustion of the sulphur. Part of the sulphurous acid combines with the base of the chloro-compound salt to form a sulphite of lime or magnesia, as the case may be; and a small portion of sulphuric acid may also be formed, which would form a sulphate of the base: by this means the chlorine or chloro-compound, remaining in the wet goods, is liberated, and permitted to exert its bleaching action upon the goods. The patentee states that, in this process, certain chromates, manganates, hypermanganates, &c., may be occasionally substituted for the ordinary bleaching liquids.

The second part of this invention consists in improvements in the preparation of materials from flax, hemp, and other plants for spinning and felting.

The processes for preparing the materials, though possessed of some features common to the whole, vary according to the purposes to which the fibre is to be applied;—that is to say, according as the fibre is required to be long or short, fine or coarse, and the machinery, by which it is to be spun, is adapted for spinning one or other sort of fibre. The patentee states that by the term "fibre" he means that portion of each plant which is capable of being spun or felted; and the invention applies to the fibre surrounding the stems of *dicotyledonous* plants, and to that existing in the stems and leaves of *monocotyledonous* plants. In the following processes, flax or hemp is supposed to be the material under operation.

If the plant is to be operated upon from the time of its

being cut down or pulled for use, it is taken in the state of straw (after the seed has been separated from it) and subjected to the following process:—The straw is steeped in a solution of caustic alkali, of about 1° of Twaddle's hydrometer, for a suitable length of time: if despatch is required, the solution is employed in a boiling state, which renders an immersion of about six hours sufficient; but, if more time can be allowed, the solution may be used at a temperature of about 150° Fahr., and the immersion prolonged for twelve hours; and the solution may even be used at a lower temperature, with a corresponding prolongation of time; but in no case need the immersion exceed a couple of days. The objects of this process are, first, to decompose, dissolve, or remove the glutinous, gummy, or other matters, which connect the fibre with the woody portions of the plant; and, second, to discharge or decompose any oleaginous, coloring, or extraneous matter contained in the straw, without permitting such discharged matters to stain the fibre. The patentee generally uses a solution of caustic soda for effecting these objects; but other alkaline liquors (such as a solution of caustic potash or lime) will answer the purpose, as also will any substance having the like power of discharging, decomposing, or removing the glutinous, gummy, coloring, or other foreign matters contained in the straw.

If the fibre is required to be long, like that commonly spun in flax-spinning machinery, the straw is now treated in the following manner, to get rid of any of the alkali still adhering to the straw or fibre, and to complete the removal of any glutinous, gummy, coloring, or other foreign matters:—The straw is taken from the alkaline solution, above mentioned, and steeped for about two hours in water acidulated with sulphuric acid, in the proportion of one part of the acid to from two to five hundred parts of water: some other dilute acids will answer this purpose, such as dilute muriatic acid; but sulphuric acid is preferred. Or the straw is transferred, while yet wet with the alkaline solution, to a suitable chamber or stove, wherein it is subjected to the action of sulphurous acid, or the fumes produced by the slow combustion of sulphur. In both cases, the acid combines with any free alkali, remaining on the straw or fibre, and forms a sulphite or sulphate thereof, according to the acid employed; while an excess of either sulphuric or sulphurous acid will complete the discharge, decomposition, or removal of the glutinous, gummy, coloring, and other matters. The straw is next removed from the acid

bath or sulphur chamber, and washed or otherwise treated with water, until all the soluble matters are removed.

If the fibre is required to be decolorized, the straw may now be submitted to one of the above-mentioned bleaching processes, or to any of the ordinary bleaching processes; and after this, it may be dried and made ready for breaking and scutching by the means commonly employed in the manufacture of long flax. In some cases, it will be found advantageous to pass the straw between rollers, or to break it roughly or partially, before subjecting it to the above process, in order to facilitate the action of the chemical agents upon it. It is stated that, by the above method, certain matters are removed from the straw which water alone cannot discharge; the fibre, so prepared, is also freer to heckle, and the straw more easy to scutch, than fibre and straw treated in the common way; much time and material are likewise saved; while the noxious exhalations, attendant upon the water-retting system, are entirely prevented.

If the fibre is required to be short—so that it may be felted or carded and adapted for spinning on cotton, silk, wool, worsted, or tow-spinning machinery, either alone or combined with cotton, wool, fur, hair, silk, or "shoddy"—the patentee takes the fibre, after it has been treated in the manner just described, and divides it into proper lengths by a suitable instrument or machine. The straw or fibre is then put into a bath, containing a strong solution of bicarbonate, sesquicarbonate, or even carbonate of soda, or any similar compound (the first two being preferred, because they contain more carbonic acid); and it is permitted to remain in such bath for three or four hours, in order that the fibre may become well saturated with the salt. It is then immersed for about a couple of hours in water, acidulated with sulphuric acid, in the proportion of one part of acid to two hundred parts of water; or else the saturated straw or fibre is exposed, while wet, to the action of burning sulphur in a suitable chamber or stove. In this operation it appears that a certain portion of gas becomes developed in the fibrous tubes, and by its expansive power it splits and divides them into filaments, having the character and appearance of fine cotton wool; and in this state they may be dyed and manufactured like cotton or wool.

As the same means of effecting the splitting of the fibre may be employed in the preparation of long fibre, the patentee does not confine himself to the use of the same for preparing short fibre alone; but he states that, when the fibre is of its

original length, the solution takes a longer time to penetrate into the interior. He likewise states, that the decomposition of the bicarbonate of soda, or other suitable compound, may be effected by electric agency;—in which case a like evolution of gas and splitting up of the fibre will take place. After the fibre has been subjected to the splitting process, it must be carefully washed, to remove all soluble matters, and dried. The splitting process may be applied to the plant either in the straw (the wood of which is afterwards to be removed by suitable means), or in the state of long fibre, whether prepared by the above or any of the usual processes.

The third part of this invention consists in manufacturing yarns and felts of the following new combinations of materials:—The patentee manufactures a yarn, which he calls flax-cotton yarn, partly of flax fibre, prepared and cut into short lengths, as aforesaid, and partly of cotton—varying the proportions at pleasure: this yarn is stated to be stronger, whiter, and more glossy than yarn composed of cotton alone; while it is equally capable of being spun in the common cotton-spinning machinery. He also makes yarn partly of hemp fibre, or jute, or *phormium tenax*, or similar vegetable fibre (China grass excepted), prepared and cut into short lengths, and partly of cotton: such yarn possesses like properties to the flax-cotton yarn. He likewise manufactures yarn partly of flax, prepared and cut into short lengths, or any like vegetable fibre (except cotton and China grass), and partly of wool, or of that description of it called "shoddy," or partly of fur or hair, or partly of any two or more of the said materials;—some wools also, which are too short to be spun by themselves, may, by being mixed with flax fibre, cut into short lengths, form a material very suitable for spinning. Yarn is likewise proposed to be made partly of flax or like vegetable fibre (except China grass), prepared and cut into short lengths, and partly of waste silk: that is, silk of the short lengths in which it exists before reeling; or silk rags cut into short lengths and carded.

Flax felts, of a fineness and softness equal to the best woollen felts, and superior to them in point of durability, are made by mixing flax fibre, prepared and cut into short lengths, with wool, fur, hair, or any other feltable material.

The patentee states, that the part of the above invention which was communicated to him from abroad, was that which relates to the combination of flax, cut into short lengths, with shoddy; and he derived his knowledge of this from one Ahnesorge, of Holstein. He claims, First,—the method of

bleaching by double decomposition, before described, whereby the various bleaching agents and compounds used may be recovered and economised. Secondly,—the method of bleaching by the combined action of chlorides, or carbonates, or chromates, or any other bleaching agent, with fumes of sulphur, as before described. Thirdly,—the preparing of flax and hemp, and of all vegetable fibre capable of being spun or felted, from whatever description of plants obtainable, by steeping the plant from which the fibre is derived, while in the state of straw, stem, leaf, or fibre, first in a solution of caustic soda, or other solution of like properties, and then in a bath of dilute sulphuric or other suitable acid, as before described. Fourthly,—the preparing of the said vegetable fibre for spinning in cotton and silk machinery, and for being combined with cotton, wool, raw silk, or other materials of short staple, by first steeping the same in a solution of caustic soda, or other solution of like properties; secondly, steeping them in a bath of dilute sulphuric or other suitable acid, or exposing them to the fumes of sulphur; thirdly, saturating them with a solution of bicarbonate of soda, or any other like agent, and then decomposing such salt,—however such decomposition may be effected; and fourthly, cutting them up into short lengths, as before described. Fifthly,—the employment generally in the preparation of flax, hemp, and other sorts of vegetable fibre, of the mode of splitting by gaseous expansion, as before described,—whether the fibre is long or short, and whatever may be the purpose to which the same is to be applied. Sixthly,—the manufacture of yarns and felts from a combination of flax or like vegetable fibre (China grass excepted), prepared and mixed, as aforesaid, with cotton, wool, shoddy, fur, hair, and silk waste, all or any of them, as before described.—[*Inrolled August,* 1850.]

To Robert Cotgreave, *of Eccleston, in the county of Chester, farmer, for certain improvements in machinery or apparatus to be used in draining land.*—[Sealed 22nd May, 1850.]

This invention consists, firstly, in certain novel constructions and arrangements of machinery for forming trenches, to be subsequently supplied with pipes, stones, or other medium used in constructing drains; secondly, in an apparatus for filling in the earth which has been removed in the formation of such trenches; and thirdly, in an arrangement of imple-

ment for loosening the subsoil, so as to effect an improved drainage thereof.

In Plate XII., fig. 1, represents, in side elevation, one form of the improved machine for cutting trenches; and fig. 2, is a cross section, taken at about the line A, B, of fig. 1.—This implement may be called a drain-plough. *a, a,* is the beam, formed of two plates or bars of iron, between which there is attached a plate of metal *b, b,* extending downwards. To the bottom part of this plate is attached a bar *c, c,* forming an inclined plane, which carries, at its forward end, a coulter or cutter *d.* The forward end of the beam *a, a,* is provided with two pendent arms *e, e,* to the lower ends of which is attached a block *f, f.* Beneath this there is placed another block *g, g,* to which are firmly attached pins *h, h, h*;—these pins project into sockets, formed in the upper block *f, f,* and move loosely therein, so as to act as parallel guides for the moveable block *g.* *i, i,* are two upright rods, to the lower ends of which the block *g,* is jointed: they are suitably formed for moving in screw-sockets, placed within the beam *a, a,* and are provided, at top, with handles; by turning which the block *g, g,* can be raised or lowered, as desired. Projecting from the inclined plane is an angular mould-board *j, j,* mounted upon a rod *k, k,* which passes through eyes attached to the board, and through other eyes affixed to the inclined plane beam. The mould-board *j, j,* has to be moved higher up occasionally, for the purpose hereinafter to be mentioned: this is accomplished by withdrawing the rod *k,* and then shifting the eyes of the mould-board, so as to bring them above the succeeding eyes on the inclined plane-bar *c, c*;—the rod *k, k,* is then replaced. In order to enable the board *j,* to sustain the weight of earth which is to pass over it there are brackets *k**, *k**, extending from the framework of the machine, upon which it rests. *n,* is the draw-link, jointed to a bar *o,* attached, at the further end, to the beam of the implement, but capable of being raised or lowered, at its forward end, by means of a screw and nuts *p,*—the spring of the said bar being sufficient to admit of this motion. This means of adjustment is for the purpose of varying the height of the point at which motion is communicated to the machine. The action of this apparatus is as follows:—Upon the application of horse or other power to the draw-link, the coulter or cutter *d,* will be caused to advance into the earth, and the loosened soil will be forced up the inclined plane *c*; and thence falling on to the mould-board, will be thrown on one side of the trench that is being cut. The block *g,* presses upon the

soil where a slice has been previously removed, and, by its plane surface, forms a guide to keep the cutter from advancing unduly into the earth.

When the intended length of trench has been cut, the machine must be raised, and, by working in the opposite direction, another slice will be removed; the attendant drawing up the mould-board *j*, by the means above-mentioned, as the apparatus lowers into the increasing depth of the trench. The thickness of the layer of soil removed will, of course, depend upon the height of the block *g*, above the point of the cutter, and may be regulated by turning the screwed rods *i*, so as to raise or lower the block *g*. As the machine sinks into the deepening trench it will be necessary to unscrew the eyes *m*, *m*, in order to cause a plain surface of the side of the inclined plane to move against the sides of the drain.

In using this arrangement of apparatus, one or more may be employed for forming the entire depth of the trench: for example, one of light construction may be used for cutting the drain down to a portion of its extent, and another or others, of greater depth and strength, employed, as the cuttings progress; and they may, if desired, be furnished with ordinary wheels, to facilitate their being conveyed from place to place,—such wheels being capable of removal when required.

Fig. 3, shews, in elevation, a similar machine to that already described, but with certain additions thereto, which are more particularly applicable when the earth is to be removed from the lower part of the trench. The beam and inclined plane are shewn, as before, at *a*, and *c*. To the upper part of the beam is, in this instance, attached a bar, provided with a bearing, which carries a short shaft *q*, forming the axle of a spike-roller, the teeth of which take into the surface of the earth as the machine is drawn forward. On the same shaft is also mounted another roller *s*, —a series of spikes formed upon which project into the slice of earth as it advances up the inclined plane. By this arrangement, the shaft will be caused to revolve; and the roller, by the action of its teeth, will assist the severed soil in its passage up the inclined plane.—It will be understood that, as the opposite end of the bar to that which carries the shaft is fixed to the frame, the roller, in passing over any inequalities of the surface of the ground, will be enabled to yield a little, by reason of the bar acting as a spring.

If it be desired to use this additional apparatus during several successive operations, spike-rollers, of different diameters, should be employed, so as to run in contact with the surface

of the ground, as the machine, and, consequently, the shaft *q*, falls lower down.

Fig. 3, also shews another additional apparatus which may be employed to assist the passage of the earth up the inclined plane. At the under side of the bar *c*, is mounted in bearings a revolving disc *t*, upon the axis of which is a toothed pinion, taking into another mounted upon an axle, also carried by the bar *c*. Upon the latter axle is affixed a thin spiked roller *u*, which projects through the inclined plane; so that, upon the machine moving forward, the disc *t*, will be caused to revolve and communicate motion to the roller *u*; thus lifting the slice of earth and tending to advance it to the top of the machine. In this figure the blocks *f*, and *g*, are formed of hollow iron,—the upper one fitting into the cavity of the lower one, which is capable of being raised and lowered by means of screw-rods, as before. The lower block is, in this instance, provided with four circular knives, mounted on each side thereof; two of which are shewn at *v*, *v*. These knives are capable of turning upon centres, and are level with the faces of the block *g*; they operate so as to cut the sides of the earth intended to form the slice, and may (if desired) be employed in all forms of the guide-block; or cutting surfaces, to act similarly, may also be employed, but formed as stationary knives.

Fig. 4, represents, in elevation, a modification of the above-described machine. In this instance, two inclined planes and cutters are employed,—the one calculated to remove the earth a thickness deeper than the other, so as to sever two slices at one advance of the machine. In like manner three or more may be employed, if desired;—the general arrangement of parts being the same as in the former cases, no further description will be necessary; it being understood that but one mould-board, similar to that shewn at *j*, and placed on the lower inclined plane, will be necessary. Fig. 5, is a partial view, shewing a variation in the method of shifting the guide-block in front of the machine. In this instance the block *f*, is jointed upon arms *e*, *e*, which turn on pins passing through the beam *a*. To one of them is connected a segmental piece *w*, which has a series of pin-holes formed therein, and passes through a mortice formed in the beam: by raising or lowering the upper end of this segmental piece, the blocks will swing upon the arms and be caused to rise or fall, and at the same time recede from or advance towards the cutting-tool, and be thus adjustable in both directions. The arms *e*, *e*, are also provided with several pin-holes, which may be used

to alter the level of the blocks when a great variation is required. In order, however, to gain increased facility for regulating the thickness of slice to be severed; screw-rods *i*, *i*, similar to those before described, are employed.

Fig. 6, represents, in a detached view, a plan for assisting the upward passage of the earth. Within the inclined plane-bar is placed a series of rollers *x*, *x*, *x*, turning upon suitable centres; and around these is passed a belt of cloth or other material, upon which the raised soil advances.

Fig. 5, represents, in a detached view, an arrangement for governing the cut more accurately. Behind the cutting-tool is placed a block *f*, affixed to an extended portion of the plate *b*; and below this is placed another block, in a similar manner to those described with reference to the preceding figures: by raising or lowering the block *g*, through the intervention of the screws *i*, great accuracy of adjustment may be acquired. The cutter to be affixed to this description of machines may be varied considerably in form; that, however, which is preferred for general purposes will be seen more particularly by reference to figs. 1, and 2. There are two vertically cutting projections *y*, *y*, which sever the sides of the slice; if desired, however, discs, similar to those shewn at *v*, *v*, fig. 3, may be employed. The shape of the tool may likewise be varied to suit the form which it may be desired to give to the bottom of the trench: for instance, in cases where sods are adopted instead of tiles, the cutter employed to remove the last slice may be so constructed as to leave a ledge on each side for the sods to rest upon. In some instances the top part of the drain, where such has been formed to a considerable depth, may be wider than the lower part thereof; in which cases a spring is applied to the incline plane-bar, so as to press the plate *b*, against the side of the drain; and, to prevent the loose earth from falling into the trench between the machine and the side thereof where the spring is employed, a projecting piece is attached to the machine, so as to cover the aperture of the space.

The mould-board *j*, is shewn in the drawings as in one piece; if desired, however, it may be made in two or more,—the one lapping over the other, so as to be capable of expansion, in order to gain greater breadth.

The patentee remarks that, if desired, his improved draining-machines may be made with two inclined planes, one on each of the plates *b*; in which case the earth will be brought up in a similar manner to that already described, but thrown upon the surface of the ground on both sides of the drain.

Fig. 8, shews an improved construction of machine for filling in the earth which has been thrown up in forming drains. To a beam *a*, is attached an angular frame *b*, which is provided with a number of tines *c*, *c*, *c*, similar to those of an ordinary harrow; and projecting downwards from the parts *b**, *b**, of the frame, are also plates or scrapers. The machine is used in the following manner:—The forward part of the beam *a*, extends below the bottoms of the tines *c*, *c*, *c*, and is placed so as to project into the formed trench,—the tines *c*, *c*, *c*, will then rest upon the earth intended to be filled in, and, on a forward motion being communicated thereto by horse or other power, will loosen the soil, so as to enable it to be drawn towards the centre part of the machine by the scrapers extending from the frame *b**, *b**, when it will fall into the open trench. In some cases, where the ground to be cut is comparatively dry, a series of rollers, mounted upon axles, may be placed at the bottom of the guide-block *g*, as shewn in the detached fig. 7: they may be of any convenient number, and formed of wood, or of metal, as desired.

Fig. 9, is a side elevation, and fig. 10, a plan or horizontal view, of an implement for loosening the subsoil, so as to effect an improved drainage. The frame or beam of the machine is shewn at *a*, to the front part of which is attached a block, similar to that described with reference to the foregoing figures. In this instance, however, there is but one block, which moves upon guide-pins *h*, *h*, and is capable of being moved up or down by means of screwed rods *i*, *i*; but there is added another block *z*, placed parallel with the first-mentioned, and connected thereto by means of arms; its use being to move in the adjoining furrow, and act as a parallel guide. A mould-board, of the ordinary construction, is shewn at *b*, and behind this is a coulter or stirrer *c*, (for loosening the subsoil) placed in a mortice, formed in the beam or framework, and capable of being adjusted by set screws, so as to regulate the depth to which the subsoil shall be moved. By this arrangement of apparatus the upper soil is turned in the ordinary manner, and the subsoil loosened by the instrument *c*, which is prevented from advancing unduly into the earth by the plane surface *g*, which precedes it.

The patentee claims, Firstly,—with reference to the formation of drains or trenches, the use of an inclined plane or planes for conveying the severed soil to the surface of the ground, in combination with an adjustable flat guide-piece, with or without rollers attached thereto, acting as a regulator for the depth of cut;—and also (for the purpose above set forth) the spiked rollers and travelling-belt described, with

reference to fig. 3. Secondly,—the use of a machine, provided with tines, or spikes, or scrapers, disposed in an angular form, so as to draw the earth towards the central part, for the purpose above set forth. Thirdly,—the combination of a flat guide-surface and instruments for returning the subsoil, for the purpose above set forth. Lastly,—the general arrangement and construction of parts shewn and described under the three divisions of his invention.—[*Inrolled November*, 1850.]

To Moses Poole, *of the Patent Bill Office, London, Gent., for improvements in machinery for punching metals, and in the construction of springs for carriages and other uses,—being a communication.*—[Sealed 1st June, 1850.]

The first part of this invention consists in improvements in machinery for punching metals; which improvements are also applicable to a variety of purposes where force or pressure is required;—the feature of novelty being the employment of excentric wheels or sectors, in combination with a roller or rollers, operating in such manner as to reduce the friction, and produce what the patentee terms an antifriction press.

In Plate XII., fig. 1, is a sectional elevation of an improved punching-machine. *a*, is the frame of the machine; and *b*, *c*, are two excentric sectors, placed between the vertical standards of the frame. These sectors are represented upon an enlarged scale at fig. 4, where the space between the dotted arc and the edge of the sector serves to indicate the excentricity of the curve. The bearing points of the sectors terminate in acute angles, to prevent friction. The point of the sector *b*, bears against a cross beam *d*; and the point of *c*, rests on a moveable piece or follower *e*, which works in guides, and is provided with a spring *f*, to raise it after it has been depressed by the action of the sectors. Between the sectors there is a roller *g*, the shaft of which works in vertical slots in the standards of the frame; and to this shaft the lever *h*, is attached. A punch or die being put in the point of the follower *e*, the roller *g*, is turned (in the direction of the arrow) by means of the lever *h*; at the same time, the roller, by acting upon the edges of the sectors, causes such sectors to move in opposite directions; and such movement, by reason of the excentricity of the sectors, produces a depression of the follower *e*, to a distance equal to the sum of the excentricities, and, consequently, forces the punch or die through a plate of metal, or other material, placed on the bed of the machine.

Fig. 2, is a sectional elevation of another punching ma-

chine, in which the roller *e*, is made to act upon a pair of excentric wheels *i*, *j*, (shewn, on an enlarged scale at fig. 5,) the shafts of which work in vertical slots in the standards; such shafts are turned at each side of the excentric wheels, so as to act as rollers; and at these points they rest upon sectors b^1, c^1, the edges of which are not excentric,—their use being to diminish friction.

Fig. 3, represents another modification, in which, instead of the roller *g*, a double excentric g^1, is used, acting upon sectors b^2, c^2, the edges of which are not excentric.

Machines constructed according to this part of the invention may be applied to other useful purposes,—such as pressing moulds or dies, embossing, straightening, or curving iron rails or plates, cutting metals, raising weights, &c.

The patentee claims, First—the combination of the central roller with two excentric wheels or excentric sectors, so as to operate upon opposite sides of said roller, as described. Secondly,—the combination of sectors, having their edges circular instead of excentric, to diminish friction, in the manner set forth—whether the same are combined with excentric wheels, as shewn at fig. 2, or with a central excentric roller, as shewn at fig. 3.

The second part of the invention consists in forming endless metal springs for carriages and other uses by producing a variety of curves in a narrow strip of metal and then attaching the ends to the main body of the strip; whereby the vibrations instead of running out at the ends, as in common springs, will pass to the points where they are joined to the main body, and re-act upon it with a certain intensity, tending to maintain the vibration: by compounding the curves great leverage is obtained, which will enable the spring to bear a much greater weight than common springs of the same weight of metal.

Fig. 6, shews a simple form of spring: the axis for supporting the spring may be at *a*, and the weight applied at *b*, or *vice versâ*. Fig. 7, is another spring, somewhat similar to fig. 1;—the forms of the outer curves being varied to increase the leverage. Fig. 8, is a spring with an increased number of curves *c*, *d*, *e*, *f*, acting as levers. Fig. 9, exhibits another variation in the shape of the spring.

The patentee claims the giving to the plate or strip of metal such forms and shapes as shall cause the ends of the strip to terminate upon and be united to the body of the same, for the purpose of forming an endless spring, as described.—[*Inrolled December* 1850.]

Scientific Notices.

THE PROVISIONAL REGISTRATION OF INVENTIONS.

The political atmosphere having somewhat cleared, there are now some hopes that the inventors' interests will not much longer be neglected. That the desire to effect somewhat on this head is possessed by the legislature there can be no doubt; for, on the one hand we have the intentions of the government plainly expressed by Earl Granville's bill for the Provisional Registration of Inventions, and his Lordship's promise of a bill for Patent Law Reform; and, on the other, we have a bill to amend the law touching Letters Patent for Inventions already introduced in the House of Lords by Lord Brougham; while, in the Commons, Mr. Ricardo has given notice of motion for a committee to take the matter into consideration. If anything, other than political troubles, should arise to blight this fair prospect, we think it will come from the want of unanimity among inventors themselves, as to what would be a prudent and equitable adjustment of the interests at stake between themselves and the public. We trust, however, that the "ventilation" which the subject has recently undergone will have removed, in some measure, the obliquity of mental vision which patent reformers of the inventive class have so generally experienced when approaching this abstruse question.

The bill for the Provisional Registration of Inventions (a copy of which was given in our March number) has, after undergoing some most important alterations in Committee in the House of Lords, been introduced in the Commons by the Attorney-General; and will, doubtless, in the early part of April, become the law of the land. On a cursory reading, the bill would seem to call for little comment, as its powers are intended to lapse with the current year; but, on a closer examination, some points present themselves which are not unworthy of attention, more especially as this may be looked upon as the precursor of a government Act for the amendment of the patent laws. It will be understood, that a registration has hitherto been simply a certificate that on such a day such a person appeared *in propriâ personâ*, or by deputy, before the Registrar, with money in hand, and desired protection for a something which he was pleased to call a *design;* whether old or new, or (in the case of an article having reference to utility) whether a fit subject for registration, or altogether beyond the scope of the Act, it mattered not; for if treated so as to meet the humour of the officials it was

sure to receive the certificate. Now, this practice, although not altogether so foreign to the system of granting patents as we could have wished, acts in direct hostility to that most valuable provision of our much decried patent system,—namely, the examination before the law officers of the Crown respecting contending claimants of an invention; inasmuch as a party who has been refused a patent by the Attorney-General, on the ground that he has no right whatever, or, at least, no exclusive right to the invention, may avail himself of the Registration Office, where no enquiry is instituted,—whereby the award of the Attorney-General is virtually annulled.

By the present bill, the duty of the Registrar is simply to register the grant of certificates of such inventions as are intended to be exhibited in Hyde Park; but the power of issuing certificates is vested in the Attorney-General, *or such person or persons as he may, from time to time, appoint;* provision is therefore made for the thorough examination of the papers which are sent in for registration, and for the rejection of such as it may be found undesirable to register. To what extent this power of refusing certificates is to be carried will depend, in a measure, upon the judgment of the Attorney-General; but, from the evidence taken by a select Committee of the House of Lords on the bill, we are inclined to think that the intention is to ensure the identity of the invention explained in the papers deposited with the Attorney-General, and the invention to be described hereafter in the enrolled specification of the patent which is to follow the grant of the provisional registration. Here then we trace the initiatory step to the appointment of a board of examiners, for which we have so long contended, and by which alone the proper working of the deposit system (the adoption of which has been received with such evident satisfaction) can be insured; and if the experiment (for the short term of the Act will render it nothing more) should prove satisfactory, we doubt not that so useful a provision will not be lost sight of, if any latitude is allowed, in the expected Patent Law Amendment Act, for making rules and orders respecting the granting of patents. In this bill we find the duties of the Registrar, for the first time, properly defined. We have hitherto been accustomed to see that ominous expression, "the judgment of the Registrar," the dread power of which it has been the lot of many a luckless wight to feel: his business, as regards inventions, is assimilated to that of the Registrar of Births, not to assist at the delivery, but to certify to the existence of

the offspring; and perhaps this may be looked upon also as the recognition of an error in the framing of the former Designs Registration Acts.

A very important amendment of the Ornamental Designs Act is also included in this bill; for by it the foreign manufacturer of fancy goods will be protected from the disgraceful competition which he has had to encounter, by reason of the most successful of his patterns (which cost him the price of artistic labor) being copied almost as soon as they appeared, and coming into the market at a lower price than he could profitably sell at. We commend this feature of the bill to the particular consideration of the ribbon weavers and paper-hanging manufacturers, as their interests are likely to be seriously affected thereby. The following is a copy of the bill, as it passed the House of Lords; and we have reason to believe that it will receive but little alteration before passing into a law:—

Whereas it is expedient that such protection as hereinafter mentioned should be afforded to persons desirous of exhibiting new inventions in the Exhibition of the Works of Industry of all Nations in 1851: Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

I. Any new invention for which letters patent might lawfully be granted may, at any time during the year 1851, but not afterwards, be publicly exhibited in any place previously certified by the Lords of the Committee of Privy Council for Trade and Foreign Plantations, to be a place of exhibition within the meaning of the Designs Act, 1850, without prejudice to the validity of any letters patent, to be thereafter, during the term of the provisional registration, hereinafter mentioned, granted for such invention to the true and first inventor thereof: Provided always that such invention have, previously to such public exhibition thereof, been provisionally registered in manner hereinafter mentioned; and provided also that the same be not otherwise publicly exhibited or used, by or with the consent of the inventor, prior to the granting of any such letters patent, as aforesaid: Provided also that no sale or transfer, or contract for sale or transfer, of the right to or benefit of any invention so provisionally registered, or of the rights acquired under this Act, or to be acquired under any letters patent, to be granted for such invention, shall be deemed a use of such invention; and the publication of any account or description of such invention in any catalogue, paper, newspaper, periodical, or otherwise, shall not affect the validity of any letters patent, to be, during such term, granted as aforesaid.

II. Her Majesty's Attorney-General, or such person or persons as he may, from time to time, appoint, to issue certificates under this Act—on being furnished with a description in writing, signed by or on behalf of the person claiming to be the true and first inventor within this realm of any invention intended to be exhibited in such place of public exhibition, as aforesaid; and on being satisfied that such invention is proper to be so exhibited, and that the description in writing, so furnished, describes the nature of the said invention so intended to be exhibited, and in what manner the same is to be performed—shall give a certificate in writing, under the hand or hands of such Attorney-General, or the person or persons appointed as aforesaid, for the provisional registration of such invention.

III. The Registrar of Designs, acting under the Designs Act, 1850—upon receiving such certificate, and being furnished with the name and place of address of the person by or on whose behalf the registration is desired—shall register such certificate, name, and place of address; and the invention to which any certificate, so registered, relates, shall be deemed to be provisionally registered; and the registration thereof shall continue in force for the term of one year from the time of the same being so registered; and the Registrar shall certify, under his hand and seal, that such invention has been provisionally registered, and the date of such registration, and the name and place of address of the person by or on whose behalf the registration was effected: Provided always that if any invention, so provisionally registered, be not actually exhibited in such place of public exhibition, as aforesaid; or if the same invention be in use by others at the time of the said registration; or if the person by or on whose behalf the said registration has been effected be not the first and true inventor thereof; such registration shall be absolutely void.

IV. The description, in writing, of any invention so provisionally registered, shall be preserved in such manner and subject to such regulations as the Attorney-General shall direct; and any invention so provisionally registered, and exhibited at such place of public exhibition as aforesaid, shall have the words "provisionally registered" marked thereon or attached thereto, with the date of the said registration.

V. Such provisional registration as aforesaid shall, during the term thereof, confer on the inventor of such invention, with respect thereto, all the protection against piracy and other benefits which, by the Designs Act, 1850, are conferred upon the proprietors of designs provisionally registered thereunder with respect to such designs; and so long as such provisional registration continues in force, the penalties and provisions of the Designs Act, 1842, for preventing the piracy of designs, shall extend to the acts, matters, and things next hereinafter mentioned, as fully and effectually as if those penalties and provisions had been reenacted in this Act, and expressly extended to such acts, matters,

and things;—that is to say, to the making, using, exercising, or vending the invention so provisionally registered, to the practising the same, or any part thereof, to the counterfeiting, imitating, or resembling the same, to the making additions thereto or subtraction from the same, without the consent, in writing, of the person by or on whose behalf the said invention was so provisionally registered.

VI. All letters patent to be, during the term of any such provisional registration, granted in respect of any invention so provisionally registered, shall, notwithstanding the registration thereof, and notwithstanding the exhibition thereof in such place of public exhibition as aforesaid, be of the same validity as if such invention had not been so registered or exhibited; and it shall be lawful for the Lord High Chancellor, if he think fit, on the grant of any letters patent to any inventor, in respect of any invention provisionally registered under this Act, to cause such letters patent to be sealed as of the day of such provisional registration, and to bear date the day of such provisional registration,—the Act of the 18th year of King Henry VI., or any other Act, notwithstanding.

VII. The third section of the Designs Act, 1842, giving the sole right to apply, as therein mentioned, any such new and original design, as therein described, to the proprietor of every such design 'not previously published, either within the United Kingdom of Great Britain and Ireland, or elsewhere,' shall be amended; and such section, and the said Act, shall henceforth be read and take effect as if the words 'or elsewhere' had not been inserted in such section.

VIII. All the provisions of the Designs Act, 1850, and the provisions incorporated therewith, relating or applicable to the designs to be provisionally registered thereunder, or to the proprietors of such designs, except the provision for extending the term of any such provisional registration, shall, so far as the same are not repugnant to, or inconsistent with, the provisions of this Act, apply to the inventions to be provisionally registered under this Act, and to the inventors thereof; and the said Designs Act and this Act shall be construed together as one Act.

ON THE AMMONIACAL COMBINATIONS OF PLATINUM.

BY M. CHARLES GERHARDT.

[Translated for the London Journal of Arts and Sciences.]

In reflecting upon the remarkable nature of the combinations of ammonia with the protochloride of platinum, the question could scarcely fail to arise in the mind, whether it would not be possible to obtain, with the bichloride of that metal, a parallel series of compounds, sufficiently stable to permit of that double inter-

change of elements seen in the platinous compounds described by M. Reiset.

There is, it is true, the biammoniacal bichloride, the chloride of the interesting series of M. Gros, which comports itself like the ammoniacal protochloride; but there exist certain difficulties, which seem, at first sight, to exclude all resemblance between the two series of ammoniacal compounds. All the salts of M. Gros are indeed chlorinated; while the two bases of the salts described by M. Reiset do not contain any chlorine. Latterly M. Raewsky has further enriched the history of platinum by a new series of similar combinations; but they correspond with an unknown chloride of platinum; and what is extraordinary, this is superior to the bichloride.

What connection exists between these salts? What relation do they present with the two ammoniacal series of the protochloride? These are questions to be now determined. By simple reasoning an important vacuity has been filled up in the series of platinic combinations, in considering the mode of formation of M. Gros, by chlorine, and one of the chlorides of M. Reiset. It was thought that the mono-ammoniacal bichloride ought to be obtained from chlorine; and the other ammoniacal chloride, of the same chemist's experiment, has fully confirmed this supposition. The new chloride, which forms octohedric crystals of a citron-yellow color, is as remarkable in its reactions as the ammoniacal protochlorides;—it undergoes double decomposition with certain other salts, and does not disengage ammonia under the influence of boiling caustic potash. When treated with nitrate of silver, chloride of silver, and ammoniacal nitrate of platinum, in which the ammonia is as much masked as in the salts of M. Reiset, the ammoniacal nitrate gives similar salts by double decomposition. It was also possible to separate (in the free state and crystallizable) the platinated alkali contained in these new salts. It is precipitated by the addition of potash or ammonia to their solution.

The researches were not limited to the first series of platinic salts. In order that the parallel should be complete between these salts and the compounds of M. Reiset, it was yet necessary to discover the salts of a second series, consisting of the same elements; and it was also necessary, in this respect, to point out the part played by the compounds of MM. Gros and Reiset. A great number of experiments have set this point at rest in a satisfactory manner. The nitrate of the second series was obtained by the action of nitric acid upon the corresponding nitrate of M. Reiset; and from the new nitrate were obtained other salts by double decomposition. The salts of MM. Gros and Raewsky are formed by the same base; they are double salts, with two acids, of which one is hydrochloric. It is easy to demonstrate this:—When hydrochloric acid is added to the neutral nitrate, the chloride of M. Gros is precipitated. When this chloride is treated with nitrate of silver, the nitrate of M. Raewsky is formed. Lastly, if hydro-

chloric acid be added to the latter nitrate, the chloride of M. Gros is again precipitated. The identity of the salts, produced in these changes, has been completely established by comparative examination with a portion of nitrate, prepared by M. Raewsky himself.

It appears, then, from the above researches, that the new salts, as well as the series of MM. Gros and Raewsky, consist of combinations of the binoxide of platinum; while those of MM. Reiset and Peyrone are compounds of the protoxide of that metal. All these salts contain particular forms of alkali, represented by ammonia, in which one part of hydrogen is replaced by a part of platinum.

According to the theory of M. Laurent, the salts of platinum of M. Reiset contain ammonia, in which an equivalent of hydrogen is replaced by an equivalent of platinum, Pt,—that is to say, by the equivalent which is contained in the platinous salts, and which may be termed platinosum.

In the new series of salts, two equivalents of the hydrogen of the ammonia are replaced by the equivalent of platinum which is contained in the platinic salts,—an equivalent which weighs one half less than platinosum, and which may be termed platinicum. The following formula shew the parallelism between the two series:—

Corresponding to the protoxide of platinum.	Corresponding to the binoxide of platinum.
NH_2Pt. platosammine. Second series of M. Reiset.	$N.H_2Pt_2$ platinammine. New salt.
N_2H_5Pt. diplatosammine. First series of M. Reiset.	$N_2H_4P_2$ diplatinammine. New salt; also that of MM. Gros and Raewsky.

[*Comptes Rendus.*]

ANALYSES OF TWO SPECIMENS OF BRONZES OF THE GALLO-ROMAN PERIOD.

BY M. SALVÉTET.

ALTHOUGH numerous analyses of ancient metallic alloys have been already published, it still appears useful that the composition of these two antique bronzes, found in a tomb in the celebrated City of Lime, should be made known, as researches of this kind have an incontestible value for the industrial arts; and beyond this and the general interest they possess, they serve to give some idea of the state of chemical knowledge among the ancients.

It is much to be regretted, that all analyses of a similar description to those which form the subject of this memoir have not been accompanied by sufficiently precise details with respect to the circumstances which led to the discovery of the metallic alloy, and the epoch to which it is supposed to belong. These details would certainly throw considerable light upon ancient

metallurgy; for, although it is true that the application of the principles of art is well shewn in most subjects of ancient origin, without a knowledge of their period, our positive knowledge of the processes practised by the ancients in different ages of antiquity can receive but little addition. Much time will yet doubtless pass away before this question will be materially elucidated; in the meantime, no opportunity should be lost of entering into investigations connected with the chemical part of the subject. It seldom happens that antiquaries are willing, from the love of another branch of science, to sacrifice the whole or part of that which chance has thrown into their hands, or which has cost them lengthened search, expense, and pains. The author of this paper was so fortunate as to have an opportunity afforded him by M. Feret, of Dieppe, of examining the chemical composition of two bronze rings, which he had himself found under circumstances of the whole of which he has preserved a particular account. In it he describes the locality whence the rings were obtained, and the people and period to which they are supposed to have belonged.

One of these rings was in bronze, externally blackish, fragile, and with a greyish fracture; it was about 13½ millimetres in external diameter, and was found in a state of complete preservation. Its composition was as follows:—

Tin	23·52
Copper	75·55
Lead	0·47
Loss	0·46
	100·00

with traces of silver, nickel, and antimony, but no zinc.

The other ring was less fragile than the first, and its fracture was slightly yellow. Its exterior was not of so dark a color; and its diameter externally was 22½ millimetres. It shewed here and there points of alteration, in which carbonate of copper was formed of a green color. The composition of this ring was—

Tin	15·73
Copper	79·93
Lead	3·50
Loss	0·84
	100·00

with traces of silver, without nickel or zinc.

Both these rings were found in the same tomb. The following is an extract from a letter of M. Feret, in which he enters into the subject of the supposed origin of these bronzes:—

"I found these rings in 1826, among others of the same kind, in a Gallo-Roman tomb, which, according to appearances, dated from the latter half of the fourth century.

"Among the medals scattered about in the same monument, the latest in date was of the time of Fl. Valens, who died in 378. The pottery found near the skeleton, which the tomb enclosed, belonged, judging from its character, to the same epoch.

"It should be remarked, that this tomb, situated on the border of a *folaise*, was in the City of Lime, a vast enclosure, surrounded by entrenchments about a league to the north-east of Dieppe; and that in the soil of this enclosed space are found the remains of several periods of antiquity, differing much from one another. The epoch, purely Gallic, is frequently shewn by its remains; and, in the inferior strata of the soil of this tomb, are discovered pottery, hatchets, and medals, supposed to be Celtic. I believe, however, that the rings now analysed belong to the fourth century, as they resemble other objects of the same nature, which I have been able to class with other Gallo-Roman antiquities."

The absence of zinc in the compounds or alloys described above is not surprising. M. Gœbel announced long ago, both from his own researches and those of Vauquelin and Klapsoth, that the bronzes of ancient Greece and her colonies, no matter whether found in Greece, Italy, Egypt, or Asia-Minor, are all composed essentially of lead, copper, and tin, or simply of copper and tin. The analyses of ancient Grecian medals, performed in the laboratory of M. Erdmann, also confirm this opinion. The analyses of M. Fresenius, of M. Knapp, made upon Celtic bronze weapons, those of M. Moëssard, of ancient bronzes, found in the department of the Oise, belonging to the Roman period, and, lastly, those described in the present paper, tend to generalise the fact stated by M. Gœbel, and to extend it to the Celtic, Gallo-Roman, and Roman epochs.

The presence of nickel in one of the rings taken from the tomb of the City of Lime is not an isolated circumstance. M. Fresenius also detected its presence in a Celtic hatchet, found near Geissen; and M. Knapp has likewise found it in a Celtic hatchet, which was buried in a peat-bog near Ceriguey-Druydon, in the Pays de Galles.

The excellent preservation of the rings described above is probably attributable to the large proportion of tin which enters into the composition of the alloy of which they are made.—[*Annales de Chemie et de Physique.*]

ON THE EMPLOYMENT OF HYDROGEN IN THE ANALYSIS OF MINERAL COMPOUNDS.

BY M. L. E. RIVOT.

THE reducing action of dry hydrogen gas, at a more or less elevated temperature, on many metallic oxides, may be usefully employed in separating these oxides from other fixed bases, upon which hydrogen is incapable of acting at any temperature whatever.

By the employment of hydrogen, it is possible to separate with exactitude oxide of iron from the earths alumina, glucina, zircona, and also from oxide of chromium, oxide of tin, and silica.

Separation of oxide of iron from alumina.—The process for separating these, laid down in books upon chemical analysis, consists in treating a weighed mixture of the two oxides with potash, in the dry method, by fusion in a silver crucible, or by the solvent action of potash upon alumina after its precipitation from its solution in an acid. This process is tedious and not quite exact, unless the potash is perfectly pure. As the separation of the two oxides is a problem often presented to the chemist in the analysis of mineral substances and the products of manufacture, the substitution of some process, more certain and rapid than the above, has been a desideratum. A very exact result has been obtained by reducing, by means of dry hydrogen gas at a red heat, the iron in a weighed quantity of the mixed oxides, which had been previously precipitated from an acid solution by ammonia. The whole must be allowed to cool in the atmosphere of hydrogen; and must afterwards be treated with cold dilute nitric acid, which will easily dissolve out the iron, leaving untouched the alumina, which, after continued calcination, is quite insoluble in weak acid. It requires but little explanation to make the mode of operation quite clear.

The oxides of iron and alumina are precipitated together by the ammonia. The precipitate is dried, and separated from the filter; the latter is then burned, and its ashes added to the oxides. The whole is calcined in a platinum crucible at a bright red heat, and afterwards pulverized and weighed with accuracy; it is then placed in a little porcelain vessel, which is also weighed, and afterwards introduced, with its contents, into a porcelain tube, placed horizontally across a furnace. To one of the extremities of this tube is adapted a tube of glass; and to the other a tube leading from a reservoir of hydrogen, dried by being passed, first through sulphuric acid, and afterwards over chloride of calcium. When the atmospheric air is completely driven out of the apparatus, the porcelain tube must be gently and gradually heated until it becomes red hot; and this temperature must be maintained so long as it is seen that water condenses on the sides of the glass tube leading from the apparatus: upon the average, about an hour will be found sufficient to complete the reduction. Continuing the current of hydrogen, the tube is now allowed to cool, and the little vessel containing the mixture is withdrawn and weighed. The loss of weight indicates the loss of oxygen from the peroxide of iron, and affords data for the calculation of the quantity of iron originally present. When the alumina is in very great excess, however, and the current of hydrogen has not been extremely slow, a small quantity of alumina may have been carried off by the gas;—in that case, the loss of weight would be too great to

indicate the exact quantity of oxygen, and would lead to an over-estimation of the quantity of iron.

The mixture of metallic iron and alumina, left after the operation of the hydrogen, is digested in dilute cold nitric acid for twenty-four hours. Pure acid must be used for this purpose; and nitric acid, of the ordinary strength, must be diluted with at least thirty times its volume of water. The solution of the whole of the iron is effected when the alumina assumes almost a white color. The alumina is separated from the solution of the iron by filtration;—from the fluid, first heated, to ensure complete peroxidation of the iron, the latter is precipitated by ammonia: thus both oxides may be estimated directly. When the proportion of alumina is small, a very exact result can be obtained, by only estimating the iron from the loss of weight under the influence of the hydrogen,—taking that loss of weight to represent the oxygen of the peroxide of iron. The following mixtures of peroxide of iron and alumina were submitted to analysis by the above method. The results will be seen in the table:—

	1.	2.	3.
Alumina	gr. 0·500	gr. 0·152	gr. 0·053
Peroxide of iron	„ 0·500	„ 0·427	„ 0·526

	1.	2.	.3
Loss of weight in the hydrogen	gr. 0·156	gr. 0·132	gr. 0·161
Corresponding to peroxide of iron	„ 0·510	„ 0·431	„ 0·527

Upon afterwards weighing the oxide of iron and the alumina, separated by dilute nitric acid, there was found—

	1.	2.	3.
Alumina	gr. 0·492	gr. 0·148	gr. 0·052
Peroxide of iron	„ 0·498	„ 0·428	„ 0·524

By these numbers, it will be seen that the separation of the oxides by the above process is very exact; and that the two may be estimated accurately by weighing the peroxide of iron, and calculating the alumina by difference. The loss of weight in the hydrogen has led to a slight over-estimation of the peroxide of iron, when there is a considerable proportion of alumina present, owing to a minute quantity of that substance being carried off in the current of gas. On the other hand, when the quantity of alumina is small, the result is very exact. It ought to be remarked, that, if the mixture of alumina and oxide of iron, over which the hydrogen is conducted, be simply a mechanical one, instead of being obtained by simultaneous precipitation from solution by means of ammonia, the alumina is much more readily carried off by the hydrogen during its passage over the mass; and, consequently, the accuracy of the experiment would, under such circumstances, be somewhat vitiated.

In calculating the quantity of peroxide of iron, from the loss of weight in the hydrogen gas, the equivalent of iron has been taken

at 339. The author has taken this number in consequence of experiments of his own on the subject: for example, in two experiments, made with great care by reduction, in hydrogen gas, of one gramme of peroxide of iron, of great purity, the following numbers were obtained:—

	1.	2.
Metallic iron	gr. 0·6931	gr. 0·6935

The mean of these two numbers, which are themselves almost identical, brings us exactly to the number 339, as the equivalent of iron.—[*Ibid.*]

INSTITUTION OF CIVIL ENGINEERS.

February 25*th*, 1851.

WILLIAM CUBITT, Esq., President,—in the Chair.

The paper read was, *A description of the "Royal Border Bridge," erected over the river Tweed, on the line of the York, Newcastle, and Berwick Railway*, by Mr. G. B. Bruce, M. Inst. C.E.

This viaduct, the total length of which was 2,160 feet, and the extreme height 129 feet, consisted of twenty-eight semi-circular arches,—each 61 feet 6 inches span; and the whole constructed of stone, with the exception of the inner parts of the arches, which were of brick laid in cement. It was divided into two parts by a central abutment, which enabled the land arches to be completed, and, along with a temporary timber bridge, to be brought into use for public traffic before the completion of the river arches, which necessarily occupied a considerable period in execution, owing partly to very substantial coffer-dams having been requisite for the river piers, but principally to its having been thought advisable to pile the foundations of most of those piers, as the bed of the river was liable to be scoured away by the rapid stream. The piles, both of the coffer-dams and of the foundations, were mostly of American elm, as it was found that the heads of the Memel piles required to be frequently cut off and re-hooped when driven by Nasmyth's steam pile-driver, which was almost entirely used, both on account of expedition and of economy; for it was proved that, whilst the hand-ram only gave one blow in four minutes, the steam pile-driver gave sixty blows in one minute; and that the cost of the former was two shillings per lineal foot; whereas that of the latter was very little more than one shilling per lineal foot. It was also remarked, that the force was more advantageously employed in the case of the steam pile-driver; as, on account of the ram being heavier and the fall less, the piles were not so frequently split.

The piers had an ashlar facing, and were filled in with well-grouted rubble, having occasional through courses of ashlar, and an ashlar tie in the centre of their width from top to bottom.

Great care was taken in the preparation of the mortar and the grout used in this work; and after a variety of experiments, the plan finally adopted was—in the case of setting lime for ashlar—to grind quicklime dry by itself in a common mill, and then to mix it with coarse sharp sand, screened out of gravel taken from the bed of the river, in the proportion of three of sand to one of quicklime; this was then put under cover until required. Lime to be used for grout was also ground dry; and along with it was ground slag from an iron furnace; then gravel from the river was mixed with it without being screened,—the proportions being, quicklime one, slag three-quarters, and gravel two and a quarter. The mortar when used had absorbed a sufficient quantity of moisture from the atmosphere and the sand to prevent its being too hot for use; and yet, as it had not been previously mixed with water and wrought into a paste, it retained its original setting power. This mortar required to be used very soft, and the stones to be well wetted; and as the sand was very coarse, thick joints were necessary; but in a few weeks it set as hard as Roman cement. All the lime used in this work was from the mountain limestone of the Scremerston and Lowich districts of Northumberland.

The centres, which were stated to have been of peculiar construction, were supported entirely from the piers, so as to prevent any accident happening if the scaffolding were injured, either by the heavy floods of ice, to which the river Tweed is subject in winter, or from the vibration caused by passing trains;—as, when the idea was first entertained of having a temporary bridge, the intention was merely to add to the contractors' scaffolding, and to make it serve for both purposes. This intention was, however, abandoned; and an entirely separate timber bridge was erected on the east side of the stone bridge, at a cost of £14,340.

The total cost of the Royal Border Bridge was £120,000; and of the whole contract, one mile in length, in which it was comprised, £207,000, including an embankment, which had to be made entirely from side cutting, and which contained probably 760,000 cubic yards.

Some valuable and interesting experiments and obvervations were given on the velocity and regimen of the river Tweed, and the results compared with the theories generally laid down relative to running waters by Buat and Eytelwein; and it appeared that, although both approximated closely to actual experiment, Buat's formula gave the best result.

March 4th, 1851.

In the renewed discussion upon Mr. Bruce's paper, descriptive of the "Royal Border Bridge," at Berwick, the question was raised as to the propriety of using ashlar and rubble, in combination, for works of this nature. Some of the speakers considered

that it was preferable to use either the one or the other alone, to prevent unequal settlement from the different character of the two kinds of work; and instances were cited of the piers of large viaducts having been entirely constructed of rubble with the most perfect success. On the other hand it was urged, that if in quarrying stone those blocks only were used which were suitable for ashlar work, much waste would arise, and great extra expense be incurred; also, that in the piers of the Royal Border Bridge, the back of the casing of ashlar was vertical; so that although externally the piers had offsets, the internal face of the ashlar did not follow that line, and therefore none of the weight which the ashlar ought to bear was brought upon the rubble. It was thought that good rubble, formed of large flat-bedded stones, well bonded, and set in good mortar, was preferable for dock walls, or in other situations where a head of water had to be supported or lateral pressure sustained,—but that ashlar was better adapted for bearing vertical pressure or weight, as in the piers of a viaduct. An important question was raised as to what weight various kinds of stone were capable of sustaining without crushing, and also what weight could be placed with safety on different kinds of artificial foundations; and the discussion was adjourned for further information on these points.

A description of a turn-table, 42 *feet in diameter, in use on the Bristol and Exeter Railway,* by Mr. I. J. MACDONNELL, M. Inst. C.E., was read.

This table, it was stated, worked on a ball-pivot, and consisted of two central cast-iron arms or brackets, which carried at their extremities hollow wrought-iron transverse girders for supporting the longitudinal timber beams, forming a framing on which were placed the rails—the outer ends being supported by other girders attached to the traversing wheels, which were 3 feet in diameter. It afforded a perfect and equal bearing throughout its entire length; not being depressed more than half-an-inch when the leading wheels of the engine struck the table; and an engine and tender, together weighing 40 tons, were turned by the driver and stoker in three minutes. Tables on this principle had been erected both at Bristol and Exeter, and the cost, with the foundation, did not exceed £400 each.

After the meeting Mr. Penrose exhibited the spiral instruments recently invented and registered by him, called *Penrose's screw helicograph, or logarithmic spiral compass,* and *Penrose and Bennett's sliding helicograph.*

In the latter instrument, with which volutes, and other forms of the logarithmic spiral were drawn, a frame sliding upon a smooth bar was supported by a wheel, the axis of which being

set at any given angle to the bar, produced by its obliquity the converging motion in a spiral arc.

The "Screw Helicograph," used for drawing a more limited series of these curves, received its spiral action from a nut fixed in the centre of a revolving disc, which communicated motion to a screw;—carbonic paper being used for obtaining an impression of the path of the disc.

March 11th.

The paper read was—*A description of the mode of working an inclined plane of* 1 *in* 27½, *on the Oldham Branch of the Lancashire and Yorkshire Railway,* by Capt. J. M. Laws, R.N., Assoc. Inst. C.E.

The mode of working this incline was by a combination of locomotive power and gravity. It was at first proposed to be worked by a horizontal wheel, rope, and pulleys, with a locomotive engine and train at each end of the rope, so that one train might descend while another ascended the incline; but as this method appeared liable to many contingencies, by which the regular traffic would have been deranged, and the expense of locomotive power increased, a balance-weight was substituted for the descending locomotive,—one line of rails being appropriated to it, and the other retained for the goods and passenger traffic. The balance-weight consisted of a heavy brake-van, and a number of ballast waggons filled with sand; but in place of the latter, loaded coal waggons were frequently used, as there was a coal pit at the top of the incline; and this was found to be a most economical and advantageous way of working the coal traffic. When the bill was in Parliament, it was stated in evidence that there would be great danger in descending so steep an inclination; but the experience of seven years (during which period the rope had broken several times, and the brake-van had once been allowed to run down by itself, without doing any serious injury) had proved this opinion to be erroneous. The ordinary passenger trains ascended and descended the incline at from 20 to 25 miles per hour, the mode being—to stop at the foot of the incline to attach the rope,—then to back the engine so as to draw the balance train off the scotch at the top, when the steam was put on, and the train ascended. This mode of working had been attended with the most perfect success; and it was thought that if more attention were paid, in the construction of railways, to what could be accomplished by gravity and impetus, in combination with locomotive power, a great saving in the original cost of the line would be the result.

The wire ropes which had been used were manufactured by Messrs. R. S. Newall and Co.; each rope was rather more than 1¼ mile in length, 3½ inches in circumference, weighing 126 cwts., and costing £316. Their average duration was about two years and four months.

March 18th, 1851.

The paper read was—*An account of the Sea Walls at Penmaen Mawr, on the line of the Chester and Holyhead Railway*, by Mr. H. Swinburne.

These walls were described as extending over a length of one mile and a quarter, sustaining a terrace beneath the steep slope of Penmaen Mawr, through the rocky headland of which the railway was carried by means of a tunnel, about one-eighth of a mile in length. This terrace was partly cut out of the cliff on the east side of the headland; and on the west side, for a distance of 550 yards, it was wholly formed of embankment; beyond which, there was a cutting, about 110 yards in length, followed by 220 yards of terrace; then another cutting, about 350 yards in length, succeeded by an embankment, retained on the seaward side by a wall, about 260 yards of which was within the reach of high tides The original design for these walls consisted of a plain retaining wall, nearly triangular in section, 3 feet thick at the formation level, with a straight face battering, 3 inches per foot,—the back being vertical. The parapet was to have been formed of a small breast wall, 3 feet higher than the level of the rails, and 2 feet thick. The masonry was specified to be "coursed walling," squared with the pick; and the face to consist of one header and two stretchers alternately.

The works were commenced in the autumn of 1845; but, after two months' experience on the coast, it was thought advisable to deviate from the original design of a straight face to the wall, and to substitute an arc of a circle of 60 feet radius, with a slightly overhanging parapet; and to prevent the great increase of masonry which would have resulted from this alteration, the back of the wall was also curved. This was afterwards found to be impracticable; and the section was therefore materially altered. The nature of the materials not admitting of the coursed walling being executed with facility, it was determined to introduce an ashlar facing of limestone, procured from the north coast of Anglesea, and set in cement for a depth of eighteen inches from the face. The main sea wall, immediately to the westward of the headland, was now commenced; and as the embankment behind it was dependent on the completion of the tunnel, and the wall was unavoidably built in many detached lengths, it was necessary to increase the width of the base, by reducing the batter of the back of the wall. This wall had advanced very briskly during the summer of 1846, and was within 9 feet of the level of the rails, with all the lengths joined, excepting the two openings through which the materials were carried from the beach, when, on the 22nd of October, the coast was visited by a severe gale, with a 17-feet tide, which completely destroyed the central portion of the wall between the two openings, besides damaging the other portions, and sweeping away the beach in front of the

centre of the wall. In consequence of this lowering of the beach, it was decided to substitute for the central portion of the wall an open viaduct, consisting of thirteen openings, each 36 feet in clear width, and spanned by ten cast-iron girders, two for each rail, resting on solid ashlar piers, 32 feet in length, 6 feet thick under the impost, and 6 feet 8 inches thick at the footings, with semicircular ends next the sea. The remaining portions of the wall were completed with the limestone ashlar facing, taken from the destroyed length of wall, set in cement, and in many cases backed with brickwork, also set in cement; they were also built more upright, and nearly straight on the face. In order to preserve the foundations of those parts of the wall which remained uninjured by the storm, it was resolved to form a breakwater and terrace in front, by driving a zigzag row of piles in bays at right angles to each other, and to back these piles with planks, behind which an artificial beach was formed.

The parapet of the first length of wall, immediately to the eastward of the headland, was built for a length of 130 yards, from 8 feet to 11 feet higher than the level of the rails, for carrying one end of a slanting roof or "lean-to," formed of whole timbers, set close together, as a protection against stones and debris falling from the face of the cliff.

In spite of the great difficulties encountered during the progress of these walls, arising from the peculiar locality, and from the violent action of the sea, the viaduct last constructed proved perfectly satisfactory;—it was, however, shewn that, in point of expense, it would probably have been as cheap to have pierced a longer tunnel, and had a less extent of sea wall; as the contingent expenses incurred in contending with the waves were very great, and were of a nature scarcely to be foreseen and provided for by engineers.

SOCIETY OF ARTS.

February 12*th*, 1851.

CAPTAIN IBBETSON, F.R.S.,—IN THE CHAIR.

The laws of color, as applied to the effective arrangement of colored fabrics in the Great Exhibition of 1851. By F. CRACE CALVERT, F.C.S., &c., &c., of the Royal Institution, Manchester.

The Professor, in opening the subject, stated that he had three objects in view. The first was to make known the laws of color, as discovered by his learned master, M. Chevreul; the second, to explain upon what basis those laws are fixed; and, thirdly, to point out the application of those laws in the effective arrangement of colored fabrics in the Exhibition of 1851.

To understand the laws of color, it is necessary to know the

composition of light. Newton was the first to investigate this subject. He said, that light consisted of seven colors—red, orange, yellow, green, blue, indigo, and violet. But it has been distinctly proved that four of these seven colors are produced by various proportions and combinations of the three colors now known as the primitive colors, viz., red, blue, and yellow. Thus, blue and red combined produce purple or indigo; blue and yellow, green; while red and yellow produce orange: these facts being known, it is easy to prove that there are not seven, but three primitive, and four secondary or complementary colors.

One of the most simple proofs that light is composed of three colors only is obtained by placing pieces of blue, red, and yellow papers on a circular disc, and rotating it rapidly;—the effect to the eye being to produce a disc of white light. If, therefore, the eye can be deceived so readily while the disc travels at so slow a rate, what must necessarily be the case when it is remembered that light proceeds at the rate of 190,000 miles per second.

Newton was not, however, satisfied with such an experiment as this; he made several others; and found that when a ray of light underwent a refraction or deviation from the straight line equal to an angle of 60° (as is the case when it is passed through a prism), it was decomposed into what he considered to be seven primitive colors. But it may be said that this is no proof that light is composed of those colors—do they not result from the influence of the prism itself? Newton satisfactorily resolved this question. He found that if, instead of allowing the rays of decomposed light to travel far enough to form the spectrum, he passed them through what is termed a double-convex lens, and then received them on a mirror or reflector at a certain distance, a white instead of a colored spectrum was seen, the decomposed ray being restored to its original condition. There is, therefore, no doubt that light is composed of seven colors, three of which are primary, and four complementary or *completing*.

Before entering into the laws of color, Mr. Calvert stated, that it might be interesting to know what scientific minds had devoted attention to the laws of colors.

Buffon followed Newton; and his researches had special reference to what M. Chevreul had called the "successive contrasts" of colors.

Father Scherffer, a monk, also wrote on the laws of color. Goëthe, the poet, also brought his mind to bear upon the subject, and studied it to a great extent. Count Romford, a Scotch philosopher, about the end of the 18th century, published several memoirs on the laws of colors. He explained very satisfactorily the "successive" contrast, and arrived at some insight into the "simultaneous" one;—still he did not lay down its real laws.

Prieur, Leblanc, Harris, and Field, were also writers of most interesting works on this subject. The reason that they did not arrive at the definite laws of color was because they had not

divided those laws into successive, simultaneous, and mixed contrasts. These form the basis of the practical laws of color, and the honor of their discovery is due to M. Chevreul.

The reason why a surface appears to us white or brilliant is, that a large portion of the light, which falls on its surface, is reflected on the retina, and in such a quantity as gives to the surface a brilliant aspect; whilst, in plain white surfaces, the rays of light being diffused in all directions, and a small portion only arriving to the eye, the surface does not appear brilliant. The influence of colors on these two kinds of surfaces is very different. When rays of light, instead of being reflected, are absorbed by a surface or substance, they appear black: therefore white and black are not colors, as they are due to the reflection or absorption of undecomposed light. It is easy to understand why a surface appears to us to be blue;—that is due to the property which the surface has to reflect only blue rays, whilst it absorbs the yellow and red rays; and if a certain portion of light is reflected with one of the colored rays, it will decrease its intensity: thus red rays with white ones produce pink. On the contrary, if a quantity of undecomposed light is absorbed, black is produced, which, by tarnishing the color and making it appear darker, generates dark reds, blues, or yellows. The secondary colors are produced by one of the primitive colors being absorbed and the two others reflected: for example, if red be absorbed, and blue and yellow reflected, the surface appears green. There are two reasons why we can never see a perfect blue, yellow, red, &c. The first is, that surfaces cannot entirely absorb one or two rays and reflect the others. The second is, that when the retina receives the impression of one color, immediately its complementary color is generated: thus, if a blue circle is placed on a perfectly grey surface, an orange hue will be perceived round it; if an orange circle, round it will be noticed a blueish tint; if a red circle, a green; if a greenish-yellow circle, a violet; if an orange-yellow circle, an indigo; and so on.

The next point was that of the different contrasts of colors.—The "successive" contrast has long been known; and it consists in the fact, that if you look stedfastly, for a few minutes, on a red surface fixed on a white sheet of paper, and then carry your eye to another white sheet, you will perceive on it not a red but a *green* one; if green, *red;* if purple, *yellow;* if blue, *orange.*

The "simultaneous" contrast is the most interesting and useful to be acquainted with. When two colored surfaces are in juxtaposition, they mutually influence each other,—favorably, if harmonizing colors, or in a contrary manner if discordant; and in such proportion, in either case, as to be in exact ratio with the quantity of complementary color which is generated in the eye: for example, if two half-sheets of plain tinted paper—one dark-green, the other red—are placed side by side on a grey piece of cloth, the colors will mutually improve in consequence of the

green, generated by the red surface, adding itself to the green of the juxtaposed surface; thus increasing its intensity,—the green, in its turn, augmenting the beauty of the red. This effect can easily be appreciated if two other pieces of paper, of the same colors, are placed at a short distance from the corresponding influenced ones, as below;—

RED. RED-GREEN GREEN.

It is not sufficient merely to place complementary colors side by side to produce harmony of color, since the respective intensities have a most decided influence: thus pink and light-green agree—red and dark-green also; but light-green and dark-red, pink and dark-green, do not; and thus, to obtain the maximum of effect and perfect harmony, the following colors must be placed side by side, taking into account their exact intensity of shade and tint.

HARMONIZING COLORS.

Primitive Colors.	Secondary Colors.	
Red	Green	Light-blue Yellow. Red.
Blue	Orange	Red. Yellow. Blue.
Yellow-orange	Indigo	Blue. Red. Yellow.
Greenish-yellow	Violet	Red. Blue. Yellow.
Black	White	Yellow. Blue. Red.

If respect is not paid to the arrangement of colors, according to the above diagram, instead of their mutually improving each other, they will, on the contrary, lose in beauty. The great importance of these principles to every one who intends to display or arrange colored goods or fabrics at the Great Exhibition was convincingly shewn by Mr. Calvert, from a variety of embroidered silks (kindly lent by Mr. Henry Houldsworth), calicoes, and paper-hangings; which demonstrated that if these laws are neglected, not only will the labor and talent expended by the manufacturer to produce on a given piece of goods the greatest effect possible be neutralized, but perhaps lost; and also, if the goods of two contiguous exhibitors be injudiciously placed, the brilliancy of their colors will be materially affected, and, consequently, the principal object of the exhibition would be frustrated—that of affording fair play, and of producing, with the goods sent, the best effect possible. It was clearly demonstrated, that these effects are not only produced by highly-colored surfaces, but also by those whose colors are exceedingly pale; as, for example, light-greens or light-blues with buffs. From the "mixed con-

trast" arises the rule, that a brilliant color should never be looked at for any length of time, if its true tint or brilliancy is to be appreciated; for if a person looks, for example, at a piece of red cloth for a few minutes, green, its complementary color, is generated in the eye, and adding itself to a portion of the red, produces black, which tarnishes the beauty of the red. This contrast explains, too, why the tone of a color is modified, either favorably or otherwise, according to the color which the eye has previously looked at. Favorably when, for instance, the eye first looks to a yellow surface and then to a purple one; and unfavorably, when it looks at a blue and then at a purple.

Mr. Calvert also shewed, that black and white surfaces assume different hues, according to the colors placed in juxtaposition with them: for example, black acquires an orange or purple tint if the colors, placed beside it, are blue or orange; but these effects can be overcome, in the case of these or any colors, by giving to the influenced color a tint similar to that influencing it. Thus, to prevent black becoming orange by its contact with blue, it is merely necessary that the black should be blued, and in such proportion that the amount of blue will neutralise the orange thrown on it by influence. As an instance:—to prevent a grey design acquiring a pinkish shade through working it with green, give the grey a greenish hue, which, by neutralising the pink, will generate white light, and thus preserve the grey.

February 19*th*, 1851.

The discussion which followed the reading of Mr. Crace Calvert's paper, at the last meeting, was resumed by his recapitulating the main divisions of the subject. In the course of this he expressed his opinion, that the common division of colors into primary, secondary, compounded of the primary, and tertiary, compounded of the secondary, was erroneous. Tertiary colors, in that sense, did not exist, and were, in fact, nothing but secondary colors, "lowered" or "toned down" by the addition of the black which would inevitably be generated by their mixture.

This opinion was combatted by several members, as contrary to fact; as olive, for example, which is one of the so-called tertiary colors, obviously contains a portion of red, and cannot be alone formed by blue, yellow, and black, as maintained by Mr. Calvert.

It was suggested, that an illustrated manual, containing the laws of contrast and harmony of colors, might be found particularly useful to our exhibitors.

Description of the Cottager's Stove. By John Grant, Esq.

This stove is designed solely for the benefit of the working classes, from a conviction that a simple and efficient cooking-stove, combined with comfort and economy, was much wanted by them. It is arranged for either a close or an open fire, and the fire-pots are adapted to every description of fuel;—the consumption of which is about 1 lb. of coal or coke per hour in the circular fire-pot (which is the most economical form); and the open fire-pot consumes nearly $1\frac{1}{2}$ lb. per hour. The square fire-pot, for wood or turf, makes a cheerful fire, and is adapted for emigrants and countries where coal is not to be procured; for, as this stove requires no fixing, it will cook well in any situation with a good draught, whether placed in a room or on the mountain-side.

It had been said that the stove would cook sufficient for a family of a dozen persons, with a consumption of 1 lb. of coal or coke per hour; but the inventor had no hesitation in stating, that it was capable of *roasting, baking, boiling,* and *steaming* 200 lbs. of meat and 100 lbs. of potatoes, with a consumption of 15 lbs. of coal, at a cost of *twopence.*

On this point the members had an opportunity of satisfying themselves, as the stove was in action the whole evening.

In this respect, it forms a strong contrast to the ordinary kitchen ranges, with their wasteful consumption of fuel, sending the greater part of the heat up the chimney. If the principles of this stove were carried out upon an extended scale, it is conceived that it might be found efficient for club-houses, hotels, and other large establishments.

February 26th, 1851.

On his improvements in the application of electro-magnetism to clocks; with a description of the clock which he is constructing for the Building for the Great Industrial Exhibition. By Mr. Charles Shepherd, jun., Member.

In all the electro-magnetic clocks which have hitherto been made, the attractive and repulsive forces of magnets have been applied directly to the pendulum; and, consequently, any variation in the intensity of the electric current will produce a corresponding variation in the motion of the pendulum, which, as it vibrates, has to move the hands of the clock, as well as the slide-break at the end of its vibrations.

Now, in all these cases, we have an unequal power; and the pendulum having to overcome resistance at the end of its vibration, could not be made isochronous;—consequently, such a clock could never be made to measure correct time.

But if, instead of applying the magnetic power directly to the

pendulum, it were employed (on the principle of the Remontoir escapement) to bend a spring to a certain fixed extent during each vibration (which spring, in unbending, should give the necessary impulse to the pendulum), the pendulum would thus be totally independent of variations in the electro-magnet,—that power being simply employed to bend the spring. In the author's first application of this principle, the pendulum is suspended from a triangular framing, and vibrates through a hole in the bed-plate, on the opposite end of which is fixed a steel spring, reaching along the bed-plate to the side of the pendulum. This spring is limited in its motion by two screws. On one side of the bed-plate is secured an electro-magnet, its poles approaching very near to one another; and on the spring, opposite the poles of the magnet, is fixed a piece of iron, on which the attractive force of the magnet is exerted, when it is required to bend the spring. The spring, when bent by the magnet, is held by a detent, and cannot return until the detent is lifted out of the way. Through the pendulum-rod are passed two screws,—one with a flat termination, to receive the pressure of the impulse-spring; the other having a conical termination, to act as an inclined plane to lift the detent: the former is the impulse-pallet; and the latter the discharging pallet. A delicate spring, insulated on ivory, is so situated that, at each vibration to the right, its point shall touch the side of the pendulum-rod, close up to the centre of motion.

Suppose the pendulum to be in the course of its vibration to the left, the discharging pallet lifting the detent releases the impulse-spring, which immediately falls against the impulse-pallet. The pendulum, having arrived at the extent of its motion, returns; the impulse-spring following it, presses it forward by its elasticity until stopped by the banking-screw. As the pendulum continues its motion to the right, it completes the circuit through the coils of the electro-magnet, by contact with the insulated spring before mentioned. The electro-magnet attracts the piece of iron attached to the impulse-spring, which is, in consequence, bent, and passes the end of the detent. The pendulum, commencing its motion to the left, breaks contact with the insulated spring; and the electro-magnet no longer attracting the piece of iron attached to the impulse-spring, the latter would return if not prevented by the detent, which holds it until raised by the discharging pallet. When the pendulum receives another impulse, the spring is again bent; and so on for each vibration of the pendulum.

This pendulum was found to vary in time, on account of the residual magnetism holding back the impulse-spring.

To overcome this difficulty, a second spring was fixed to the same bracket, beneath the impulse-spring, and parallel with it;—the armature which the magnet attracted was attached to this spring, instead of to the impulse-spring. In the end of the stem of this spring a brass pin is fixed, rising up by the side of the impulse-spring. The electro-magnet attracts the piece of iron

attached to the lower spring; but, in consequence of the brass pin in its point, it cannot be bent without bending the impulse-spring at the same moment. On the cessation of the power of the magnet, the elasticity of the lower spring overcomes the residual magnetism, and returns with the iron attached to its original position, leaving the impulse-spring locked upon its detent, ready to give the impulse, uninfluenced by either the power of the magnet or its residual magnetism.

The main advantage of this method of actuating a pendulum over all previously proposed is, that an excess of power may be employed, which is absolutely necessary with electro-magnetism; while, at the same time, the pendulum receives a perfectly regular accession of power each vibration.

The method preferred for moving the hands of small clocks is that of attraction and repulsion. A pair of pallets, taking into the teeth of the escape-wheel, are fixed upon an axis, on which are also fixed two bar-magnets; beneath the poles of which are placed two electro-magnets. These are caused alternately to attract and repel the bar-magnets,—thereby imparting an oscillating motion to the pallets, which act in the teeth of the escape-wheel and drive it forward: the motion thus produced is carried through a train of wheels in the ordinary manner. In producing the required electric currents, two contact-springs and two batteries are employed;—the contact-springs are mounted on an ivory bracket, one spring on each side of the pendulum-rod, with which their points make contact close up to the centre of motion, at the end of the vibrations of the pendulum each way. The batteries are arranged in connection with these springs, so that the circuit of each battery shall be in a contrary direction to the other. Consequently, as the pendulum vibrates to the right, it completes the circuit of one battery;—the electricity passing through the coils of the electro-magnets, they cause one oscillation of the bar-magnets. On the opposite vibration of the pendulum, it makes contact with the opposite spring; and the battery in connection with this being arranged in a contrary direction to the former, the electricity passes through the coils of the electro-magnets in a contrary direction,—causing an opposite oscillation of the bar-magnets, and consequently of the pallets, which, operating on the teeth of the escape-wheel, drive it forward.

The application of the electro-magnetism to the striking part is thus effected:—The escape or seconds-wheel is furnished with a projecting pin, which is thus carried round once in a minute. The minute-wheel, carrying the minute-hand, has a similar pin, which only completes its circuit once in the hour; in consequence of which the two pins are in conjunction only once in that time, namely, exactly at the hour. On an arbor, in the frame of the clock, is fixed an elastic arm, which is insulated from the arbor by an ivory bush. This arm carries, at its extremity, a small pad or table of platinum, on which, if it be sufficiently raised,

the pin of the escape-wheel rubs in passing. The arbor also carries a rigid arm in such a position that the pin in the minute-wheel lifts it as it passes each hour; but the arm cannot be raised without the elastic arm, also carried by the arbor, being lifted, by which the platinum table, at its extremity, comes into contact with the pin in the seconds-wheel,—an occurrence which takes place at the hour; the hands being properly adjusted to that end. By so doing, it completes the circuit of a battery, which has one pole connected with the clock-frame and the other with the coils of the electro-magnet. Now, the only break which exists in this circuit is at the small platinum pad; when, therefore, at the completion of each hour, the pad and the pin are in contact, the circuit will be rendered complete. The magnet is thus rendered active, and, by its attraction, draws down the armature. The armature is situated at one end of a lever, the other end of which carries a detent, which is received into the notches of the locking-plate. When the armature is drawn down (in other words, when the circuit of the battery is completed at the end of each hour), the detent is drawn out of the notch, and the locking-plate left free to revolve. The raising of this detent forms a contact between a wire from another battery and the clock-frame. This battery actuates a magnet, which works the actual striking apparatus. The circuit is completed through the clock-frame and through the bar-magnets, formerly described as oscillating once in every second; one end of each of which, as it rises, touches a stud immediately over it at the end of the other wire of the battery. This magnet, being therefore rendered active once in every two seconds, while the locking-plate is free, alternately attracts and repels one end of a lever, to which is attached the hammer;—the other end taking into a ratchet and click arrangement, which allows the striking to continue as long as the locking-plate is free.

A point of great importance is the method of making and breaking contact for the electric currents. When the circuit is broken, a spark is seen to pass between the points of contact. The continued action of this spark causes the points, between which it passes, to become oxidized; and as the metallic oxides are non-conductors of electricity, it follows that the passage of the electricity will be thereby interfered with and prevented.

In the author's first clock he employed a piece of steel wire as a break-spring, touching against the side of the pendulum-rod; but the points of contact oxidized so rapidly, that the clock would not go for more than a few days without stopping. The steel spring was then removed, and one of gold substituted; and a small plate of gold was soldered to the side of the pendulum-rod. The difficulty now appeared to have been entirely overcome; but, in six weeks, the quantity of electricity passing was considerably reduced, and, at the end of two months, the clock stopped.

Platinum was next tried, in the same manner as the gold, in a

new clock, completed in July, 1848; and the points of contact have never yet required cleaning,—the circuits being completed, at the present time, with as much certainty as when the clock was first put together.

In a clock to be set up by Mr. Shepherd in the Great Exhibition, it was proposed by Mr. Owen Jones that the figures should be arranged in a semicircle; because a circular dial would greatly interfere with the design of the building.

In order to indicate the time on a dial of this construction, it was necessary that the hands should be double, projecting equally on both sides of the centre. The minute-hand revolves once in two hours; and as one end leaves the right side of the dial at six o'clock, the opposite end commences at six on the left. The minute-hand is 16 feet long, and the hour-hand 12.

INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

(Continued from page 204.)

THE next paper read was,—*On the workshops for the locomotive carriage and waggon departments of the Manchester, Sheffield, and Lincolnshire Railway*, by Mr. R. PEACOCK, of Manchester.

These works are erected at Gorton, about two miles from Manchester.

The site was fixed upon, and land purchased, to construct workshops for the Sheffield and Manchester Railway only; but subsequently to the amalgamation of that Company with the network of Lincolnshire lines, and which now form the Manchester, Sheffield, and Lincolnshire Railways, more land was purchased, and the workshops increased in size to meet the wants of the joint Companies. The total quantity of land purchased is nearly 20 acres, about 9 of which is occupied by the workshops and store-yard, and the remainder is being used for the construction of reservoirs for supplying the works with water, and for erecting cottages upon for the workpeople in the Company's service.

The plot of land, which contains shops, cottages, reservoirs, &c., is bounded on the south by the railway, on the east by the Peak Forest and Macclesfield Canal (also belonging to this Company), and on the north is adjacent to the Manchester and Ashton-under-Lyne high road. The reservoirs are calculated to hold a month's consumption of water, and are supplied from the adjoining canal; the water passing through filter beds in its course from the canal to the reservoirs. These reservoirs supply the water directly into the tenders upon the railway and throughout the workshops; their position being sufficiently high to do this, and the canal

high enough to supply the reservoirs. The cottages are 140 in number, and are arranged in four blocks; and between the cottages, reservoirs, and workshops, is a plot of vacant land that may be used for increasing the number of cottages, or for any other purpose that may be hereafter required.

The plan of the works is nearly that of a square,—the watch-house or entrance being situated towards the cottages, on the east side of the works; as also is the rail entrance; and adjoining are the offices and general stores.

The engine-house or shed for working engines (see fig. 1, Plate X.,) is a rotunda of 150 feet in diameter inside, and will hold seventeen engines, with their tenders—leaving the entrance and exit lines clear. The advantage in this description of building over the ordinary polygon is in the absence of pillars for supporting the roof, there being but one in the rotunda, while in the polygon,—say of twelve sides,—there would be twelve; and the number of pillars would determine the number of lines, and consequently the number of engines it will hold: while, in the rotunda, the number of lines is, with the number of engines, influenced only by the clearance required for each other; thus, the polygon would hold eleven engines with the entrance clear, while the rotunda will hold seventeen.

To the left of the entrance is a furnace for lighting up the engines from; and the points for the two lines to the table are set so that the engines will (on entering) go upon the right hand side of the pillar; and thus, supposing them to enter engine first, they *must* be backed into each line, which will cause the smoke box, or chimney end of the engines, to be always nearest the table, and consequently in a right position for the tubes, &c., being cleaned.

The turn-table in the centre is 40 feet in diameter, with two lines of rails upon it, one upon each side the centre pillar, around which it moves. The centre pillar is of cast iron, the base forming the bed for the inner rollers of the turn-table to revolve upon: the top of the pillar is sufficiently large to receive the shoes for carrying the principals of the roof; and to it they are secured by bolts; each principal radiating from the centre of the pillar, and its opposite end resting upon the outer wall of the building. A collar is cast upon the pillar, about 8 feet from the top, which was intended to carry one end of a circular travelling frame. This frame was intended to revolve round the pillar, and to be supported at its opposite end by a carriage, running upon a circular rail-beam, sustained by the pilasters built on the inside of the walls; the frame being surmounted by a travelling crane, in the usual way: this, however, has not yet been carried out. The roof is of wrought-iron, surmounted by a louvre (see fig. 2,), the top of which is glazed;—the whole forming a well-lighted and ventilated building.

To the left of the rotunda are workshops, with engine-house, boiler, &c. The fitting and tool shop is 120 feet by 60 feet, and

contains the whole of the tools, with the exception of the punching and shearing machines. Two rows of fitters' benches are erected near the far end; the lathes, drills, &c., are placed down each side, and have their counter shafts carried by wall-plates, built into the side walls, and the planing machines are placed in the centre; the whole being driven from two lines of main shafting passing longitudinally down the shop, one over the vertical shaft from the engine, and the other equidistant from the opposite wall. This shafting is continued over the shop stores, and passes over the travelling platform into the carriage shed, for driving the hoist therein. The smiths' shop is next to the fitting shop, and is of the same dimensions,—120 feet by 60 feet; it contains a fan and sixteen smiths' fires, eight of which are placed upon each side of the shop, and if necessary three more can be placed at the ends. Next to this is the boiler shop, the same size as the smithy, in which are erected eight smiths' fires, on the side next to the smiths' shop: four boiler fires are placed upon the opposite side; and the punching and shearing machines at the entrance end;—these and the fan being driven by a shaft passing from the engine transversely across the ends of the shops. Adjoining to the left and at right angles with these is the erecting shop, which is 150 feet by 60 feet. In this shop are nine transverse lines of rails, each line holding two engines; and down the centre and each side are pillars supporting longitudinal beams for carrying the travelling cranes, one upon each side: both these cranes traverse the full length of the shop, and are each calculated to lift an engine and move it to any part of the shop, if necessary.

To the left, and bounding the west side of the works, are the waggon and carriage shops,—the waggons being on the ground-floor, and the carriages above: the carriages are lifted up and down by a self-acting worm-hoist, worked by the shop engine. These rooms are 320 feet by 70 feet; the carriage shop will hold thirty-eight carriages, and the ground-floor about fifty waggons: at the end of these are the lifting room below, and the trimming and saddlery room above,—each 60 feet by 70 feet. The lines in the lifting and waggon shops are served in common with the erecting shop by a travelling platform, 20 feet by 12 feet, running upon three rails at right angles with the lines in the shops.

Opposite the lifting shop, and forming part of the south boundary, is a paint shop, 60 feet by 40 feet, and in continuation of this is a shed for working stock not required for present use. This shed is 165 feet by 40 feet, and may be used for working engines if necessary. In a line with this and at the south-east corner of the works is the coke shed, 100 feet by 40 feet;—the coke waggons are on one side of the shed, and the engine on the other,—the coke being filled into baskets upon a platform between the engines and waggons, and transferred from thence to the engines. The waggon line side of the shed is closed; as also the

ends; but the engine line inside of the shed is open,—the roof merely projecting over the engines, where they are being coked.

The author remarked, that no difficulty had arisen with respect to the turn-table in the rotunda, or the two lines, during the two years that they had been at work. There was no danger arising from a want of balance on the turn-table when only one line was loaded with an engine, because each line of rails was carried by an independent pair of girders, supported by rollers, and joined together in the centre. They could turn an engine upon the table in about a minute, with three men; and it was sometimes done by two cleaners. The object in the arrangement had been to get as many engines in as small a space as possible, and they could find no other shape so well adapted for the purpose, or into which so many engines could be got in proportion to the area, with the same convenience and room for getting about them. The total area of the floor of the building is a little over 17,000 square feet, which is equal to 1000 square feet of shed surface per engine accommodated, with ample room to get conveniently around each, and leaving the entrance and lines clear.

A member stated, that a gain by the oblique arrangement was not very obvious. At Camden-town the rotunda was 160 feet in diameter, and held 24 engines on the old arrangement,—the space allowed for an engine and tender being 50 feet in the centre to turn. If the columns in that arrangement were placed sufficiently far back to get a clearance between the engines, he considered they would not lose any space.

The author observed, that although the columns might be put so far back as to clear the lines, columns were always very objectionable and inconvenient at the side of the engines, and he thought the central column much preferable.

It was suggested, that with a roof of only 150 feet span, the columns might be entirely done away with without increasing the cost more than £1 per square.

The next paper read was—*On an improved vacuum-gauge for condensing engines*, by Mr. F. Bramwell.

In the ordinary long vacuum-gauge, the mercury is contained in an uncovered cast-iron cup, in which is immersed a glass tube, open at the bottom end, but sealed at the top. A small iron pipe, with a stop-cock and connection to the condenser, passes through the mercury, and up the glass tube nearly to the top. By this pipe the air is exhausted from the glass tube, and the mercury rises in it in proportion to the difference between the pressure of the atmosphere and of the uncondensed vapour in the condenser. The objections to this gauge are, firstly—that it does not indicate the real pressure of the uncondensed vapour

remaining in the condenser, unless there is an opportunity of comparing it with a barometer; and, secondly—that the mercury is frequently driven out and lost, by the stop-cock being left open, while blowing through previous to starting. These gauges are also of necessity cumbrous, as they must be nearly 3 feet long, to shew the higher vacuums of 29 and 30 inches.

Fig. 3, Plate X., represents the ordinary short vacuum gauge, where a small glass tube, closed at the top, contains the mercury, and at the bottom is bent upwards, ending in a bulb, which has a small orifice on its upper side. This tube is carefully filled in the same manner as the ordinary barometer, and is then attached to a scale entirely enclosed in a glass case, which is cemented to a brass cup, terminating in a stop-cock and a pipe, by which the connection is made with the condenser, so that the air in the interior of this case is always at the same density as that in the condenser; and as the mercurial tube is only from 8 to 10 inches long, it is evident that the mercury will be held up in it by the pressure of the air in the glass case, until the density of it is reduced below that which is equal to sustain a column equivalent to the height of the tube. By this means, when it is required to shew only the higher degrees of rarefaction, as in steam engines, the gauges may be made extremely short and compact; and it is evident that they will always indicate the total pressure of the uncondensed vapour, irrespective of the state of the atmosphere. For these reasons this gauge has been very extensively used, and no doubt its employment would have been universal, had it not been for two objections. The first and gravest is, that the vapour from the condenser deposits frequently on the inside of the glass case, and forms a mist so dense as not only to render it impossible to observe the height at which the mercury is standing, but even to see the scale itself. The second objection is, that if the stop-cock is not shut off previous to blowing through, the inside of the glass becomes filled with steam or hot water, and is very liable to be broken thereby. The joint between the glass case and the brass seat generally leaks, and this to such an extent that the gauge is almost always shut off, to prevent the vacuum being injured by the passage of air into the condenser.

Fig. 4, represents the improved short vacuum gauge. The principle is precisely similar to that of Fig. 3, the difference being merely in the arrangement. Instead of immersing the whole of the tube and scale in a glass chamber connected with the condenser, the bulb only is enclosed in a brass cup, with a screw lid (on which the scale is cast); and the rest of the mercurial tube is passed through a stuffing box in the middle of this lid; protecting it from injury by sinking it in a depression in the scale like a common thermometer. On the bottom of the brass cup is the stop-cock with the pipe, by which connection is made with the condenser;—the same density is always preserved in it and the cup; and thus, the pressure being removed from the

surface of the mercury in the bulb, it of course falls according to the rarefaction,—a fall that can be always observed, as the tube containing the mercury is totally uncovered. By this means the first and great objection to the short vacuum gauge is done away, and likewise the second, which is common to both long and short, viz., the risk of the stop-cock being left open while blowing through; as with this gauge it is a matter of perfect indifference whether it be open or not, as the only thing that takes place if it is open, is, that the brass closed cup is filled with steam; but this can neither blow out the mercury, nor damage the gauge. In fact, those that the author has at work under his own control are never shut off. As regards their leakage, he has been taking every pains to get them as tight as possible; and in this he has so far succeeded, that the first one put to work, nearly two years since, on one of the pumping engines, at the Grand Junction Water Works at Brentford, retained the mercury at 29 inches for a week after the engine stopped, and no doubt would have retained it to the present day had it not been opened. The stop-cock is made with a hollow plug; this is done for neatness, and also to diminish the risk of leakage—as one end of the plug is by this arrangement contained in the pipe leading to the condenser. This could not conveniently be done with any other gauge, as there are none, it is believed, sufficiently light and compact to be carried by one point of support only, and that the plug of a cock. The author first had these gauges made in January, 1849, and since then about thirty or forty of them have been adopted, and it is understood are all giving satisfaction.

A paper was next read—*On an improved axle-box for railway engines and carriages*, by Mr. Barrans.

The attention of the writer was first drawn to the present subject by the wearing of the axle bearings at their ends, and the great number of brasses that were in consequence thrown aside as useless before being half worn through, the expense of repairing such as were retained for work, and the loss of time, as well as expense, incurred by the necessity of lifting both engines and carriages for the purpose of either renewing or repairing, and replacing the bearings so worn; and in the consideration of this subject it becomes evident that some portion of the accidents, and a large amount of expense, are to be attributed to this great source of mischief.

The engines and carriages, in the early part of their work, whilst the journals and wheels as well as the road are true, run steadily without deviating from the line of their course, whether straight or curved; but the friction of the shoulder and collar of the journals against either end of the bearings causes wear upon the latter which increases in proportion with the amount of wear. A new motion endways of the axle takes place, which, aided by

the superincumbent weight, causes the shoulders and collars to strike as well as revolve, and to beat up the metal, which is then peeled or turned off by the subsequent revolution of the shoulder or collar against the bearing: hence a twofold cause of destruction is created and actively in progress,—the rate accelerating with the progress. This work of destruction goes on until, to avoid danger to the passengers or rolling stock, or complaints of discomfort, it becomes necessary to put a stop to it either by fitting in new bearings, or by turning up, or otherwise repairing the old ones. The turning up of the wheels of both engines and carriages is a work of frequent occurrence, occasioned by the rubbing or grinding of the tire, and striking of the flanges of the wheels against the rails, which observation and experience has proved to originate in the endway motion of the axles.

The excess of endway motion being once commenced, its effects are ere long shewn in the derangement of the permanent way and of the engines and carriages running thereon.

The improved axle-box designed by the author, having so recently been described in this journal (p. 97), a brief *résumé* of its peculiarities will suffice. The box is fitted with an end bearing-piece, and is capable of being adjusted to any required distance from the end of the axle, so as to allow the latter to revolve without friction, and at the same time prevent any excess of endway motion. The end of the axle is a little rounded, and is lubricated through a hole immediately above it: the bearing-piece acts *excentrically* against the end of the axle, when in contact with it, for the purpose of ensuring its constant lubrication. The adjustment is effected by pushing up the bearing-piece to the end of the axle, and then withdrawing it a short distance, so as to leave merely a slight working clearance between the two; it is then fixed in its place by a set-screw entering one of a series of holes arranged in a spiral form round the bearing-piece, so as to allow of its being adjusted to 1-32nd inch; and the set-screw is kept in its position by a jam-nut.

This plan of steadying the axle may be readily applied to existing axle-boxes of railway stock, by bolting a boss, which is to receive the bearing-piece, on to the front of the axle-box.

The improved boxes were first applied upon the leading and trailing wheels of the Brighton express engine, which was worked with them upwards of 10,000 miles; and also upon a carriage on the South Eastern Railway, where the bearings were purposely made half an inch too short, to resemble worn bearings; by which means, in a journey from London to Dover and back, the fact of its oscillation was first manifested; and in the course of the return to London, during a short stoppage at Ashford of the train in which it ran, the end bearing-pieces were adjusted, and the oscillation consequently ceased:—one of the axle-boxes from this carriage was laid before the meeting. The engines to which the improved boxes have been applied, have become, in consequence,

so much steadier in running, that the full speed can be safely maintained over bad parts of the road, where before it was necessary to slacken speed. An important advantage is the facility with which the adjustment can be effected whenever required, without taking the engine or carriage out of the train.

The next feature is to prevent the grit or dust that is thrown up by the wheels or by the wind, finding its way between the journals and their bearings. A circular ring is attached to the inner face of the axle-box, and the corresponding ring is keyed upon the axle and revolves with it: the flanges of these rings interlock with each other without touching or causing any friction, and prevent any grit or dust from passing between them and getting to the journal. This grit-shield is not applicable to engines under the present form of their wheels and axles.

The object of the remaining portion of the invention is to prevent the waste of the lubricating material used for the journal bearings, that occurs in the ordinary axle-boxes, and to save the tallow and oil used for this purpose, and work it over and over again. For this purpose an under cap is slipped up into the lower part of the ordinary boxes, and fixed there by bolts passing through the sides: this cap (which, in new axle-boxes, is cast in one with the box) forms the receptacle for a cast-iron grease-drawer, which slides in the lower part of the axle-box, and is secured by a spring-catch. The lubricating material, passing over the journal, falls into the drawer, and may, whenever necessary, by turning over the contents of the drawer into the top of the box, be used again and again, until its lubricating properties have become deteriorated; when, by heating it gently in a vessel with a small quantity of water, the extraneous matter will sink to the bottom, and the grease and oil will become purified, and again fit for the purpose of lubrication. By this means the large amount of saving has resulted in practice of from 5-6ths to 7-8ths of the tallow and oil passed over the journals,—the material proving afterwards even of a better lubricating quality than at first, from the ingredients becoming more amalgamated.

There is another material advantage attending this part of the invention, inasmuch as oil, which is generally admitted to be a better lubricator, and more certain in its action than grease of any kind, has been mostly kept out of use, by reason of the great waste attending it in ordinary axle-boxes, and its being inapplicable in others; but in these improved boxes—the whole material being caught in the grease drawer, and again returned into the box—oil may be applied with great economy and advantage; always being ready, and keeping up its gradual and constant supply. An incidental advantage attendant on these improved boxes is, that by merely taking out the grease drawer, a convenient means is at once afforded of examining the state of the journals and boxes, which, with the ordinary boxes, it would require lifting to accomplish.

Mr. Adams remarked, that he had found that waggons and carriages did not work well unless there was plenty of end-play in the bearings; for if fitted up very close they were liable to heat. In the case of waggon bearings, he thought a play of $\frac{3}{16}$ths of an inch was requisite.

Mr. Wright was of opinion that the more play was left in the bearings, the more would be the wear; he thought $\frac{1}{16}$th inch was abundant.

Mr. Henson observed, that he did not leave any end-play in waggon-bearings; on the contrary, so accurately were they adjusted, that red lead, or something of the kind, was employed to ascertain the complete fit; in fact, they too soon acquired the play in the course of work. The only thing of importance was the grit, but with reference to that they had scarcely any trouble; and in a stock of 2,500 waggons they very rarely had cases of hot journals. He used a very large grease chamber, and hence, although there was a large quantity of grease present, the bearing was kept so cool that there was very little demand for it.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th January to the 17th March, 1851, inclusive.

To William Thomas Henley, of Clerkenwell, in the county of Middlesex, philosophical instrument maker, for certain improvements in telegraphic communication, and in apparatus connected therewith; parts of which improvements may be also applied to the moving of other machines and machinery. —Sealed 18th January.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in obtaining, preparing, and applying zinc and other volatile metals and the oxides thereof, and in the application of zinc or ores containing the same to the preparation or manufacture of certain metals or alloys of metals,—being a foreign communication.—Sealed 22nd January.

John Ransom St. John, of the City of New York, in the United States of America, engineer, for improvements in the construction of compasses, and apparatus for ascertaining and registering the velocity of ships or vessels through the water.—Sealed 24th January.

James Young, of Manchester, in the county of Lancaster, manufacturing chemist, for improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom.—Sealed 1st February.

Peter Claussen, of Cranbourne-street, in the county of Middlesex,

Gent., for certain improvements in bleaching; in the preparation of materials for spinning and felting; in yarns and felts; and in the machinery employed therein,—being partly a foreign communication.—Sealed 1st February.

John Clare, Jun., of Exchange-buildings, Liverpool, Gent., for improvements in the manufacture of casks.—Sealed 3rd February.

Benjamin Rotch, of Lowlands, in the county of Middlesex, Esq., for a factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes,—being a foreign communication.—Sealed 4th February.

John Corry, of Belfast, in the Kingdom of Ireland, damask manufacturer, for improvements in machinery or apparatus for weaving figured fabrics, which machinery or apparatus is also applicable to other purposes for which Jacquard apparatus is or may be employed.—Sealed 5th February.

Zachariah Morley, of Regent's-park, in the county of Middlesex, Esq., for certain improvements in the means or methods of, or apparatus or machinery for, decomposing water, and applying the products to useful purposes,—being a foreign communication.—Sealed 7th February.

Jasper Wheeler Rogers, of Dublin, civil engineer, for certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal.—Sealed 7th February.

Edward Clarence Shepard, of Parliament-street, in the City of Westminster, Gent., for certain improvements in electro-magnetic apparatus, suitable for the production of motive power, of heat, and of light,—being a foreign communication.—Sealed 7th February.

John Matthews, of Kidderminster, foreman, for improvements in sizing paper.—Sealed 8th February.

Thomas Wicksteed, of Old Ford, in the county of Middlesex, civil engineer, for improvements in the manufacture of manure.—Sealed 26th February.

Samuel John Pittar, of Church-lane, Clapham, in the county of Surrey, civil engineer, for certain improvements in umbrellas and parasols.—Sealed 5th March.

Charles Xavier Thomas (de Colmar), Chevalier de la Legion d'Honneur, of Paris, in France, for an improved calculating machine, which he calls "arithmometer."—Sealed 10th March.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of 166, Fleet-street, in the City of London, patent agents, for improvements in purifying water, and preparing it for engineering, manufacturing, and domestic purposes,—being a foreign communication.—Sealed 11th March.

Charles Bury, of Salford, in the county of Lancaster, manager, for certain improvements in machinery or apparatus for preparing, spinning, doubling, or twisting silk waste, cotton, wool, flax, and other fibrous substances.—Sealed 12th March.

List of Patents

Granted for SCOTLAND, subsequent to 22nd February, 1851.

To Adolphus Oliver Harris, of High Holborn, London, philosophical instrument maker, for improvements in barometers,—being a communication.—Sealed 26th February.

Joseph Crossley, of Halifax, carpet-manufacturer; George Collier, of the same place, mechanic; and James Hudson, of Littleborough, printer, for improvements in printing yarns for and in weaving carpets and other fabrics.—Sealed 3rd March.

George Smith, of Manchester, engineer, for certain improvements in steam-engines; and also improvements in feeding or supplying the boilers of the same; part or parts of which improvements are also applicable to other similar purposes.—Sealed 4th March.

John Hetherington, of Manchester, machinist, for improvements in machinery for preparing, spinning, and manufacturing fibrous substances.—Sealed 4th March.

Alfred Cooper, of Rumsey, in the county of Hants, grocer, for improvements in steam and other power engines, and in the application thereof to motive purposes; also in the method of and machinery for arresting or checking the progress of locomotive engines and other carriages.—Sealed 5th March.

Henry Richardson, of Aber Hourant Bala, North Wales, for certain improvements in life-boats.—Sealed 7th March.

William Stones, of Queenhithe, London, stationer, for improvements in the manufacture of safety-paper, for bankers' cheques, bills of exchange, and other purposes.—Sealed 7th March.

Joseph Baldwin and George Collier, mechanics, and Joseph Crossley, all of Halifax, for improvements in the manufacture of carpets and other purposes.—Sealed 12th March.

George Roberts, of Selkirk, manufacturer, for an improved manufacture of certain yarns of linen, wool, silk, cotton, or other fibrous substances.—Sealed 13th March.

Samuel Brisbane, of Manchester, pattern-maker, for certain improvements in looms for weaving.—Sealed 14th March.

George Guthrie, of Appleby, chamberlain to the Earl of Stair, for improvements in machinery for digging, tilling, or working land.—Sealed 14th March.

William Eccles, of Walton-le-Dale, in the county of Lancaster, cotton-spinner, for certain improvements in looms for weaving.—Sealed 17th March.

Edward Lloyd, of Dee Valley, in the county of Merioneth, North Wales, engineer, for certain improvements in steam-engines; which improvements are in part, or on the whole, applicable to other motive power.—Sealed 17th March.

Richard Archibald Brooman, of the firm of J. C. Robertson & Co., No. 166, Fleet-street, London, patent agents, for improvements in purifying water, and preparing it for engineering, ma-

nufacturing, and domestic purposes,—being a communication. —Sealed 17th March.

Herbert Taylor, of 46, Cross-street, Finsbury, London, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes, and strontia, sulphur, or sulphuric acid, from the sulphates of barytes and strontia, and for consequent improvements in the manufacture of carbonates and oxides of soda and potassa,—being a communication.—Sealed 19th March.

New Patents
SEALED IN ENGLAND.
1851.

To Thomas Ellis the elder, of Tredegar Iron Works, in the county of Monmouth, engineer, for certain improvements in machinery or apparatus to be employed in the manufacture of blooms or piles for railway and other bars or plates of iron. Sealed 27th February—6 months for inrolment.

William Millward, of Birmingham, plater, for certain improvements in electro-magnetic and magneto-electric apparatus. Sealed 28th February—6 months for inrolment.

Charles Felton Kirkman, of Argyle-street, in the county of Middlesex, Gent., for certain improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances. Sealed 28th February—6 months for inrolment.

Henry Willis, of Manchester-street, in the county of Middlesex, organ-builder, for improvements in the construction of organs. Sealed 28th February—6 months for inrolment,

James Leach, of Littleborough, in the county of Lancaster, cotton-spinner, for certain improvements in machinery or apparatus for carding, spinning, doubling, and twisting cotton and other fibrous substances. Sealed 3rd March—6 months for inrolment.

William Milner, of Liverpool, in the county of Lancaster, safety-box manufacturer, for certain improvements in boxes, safes, or other depositories for the protection of papers or other materials from fire. Sealed 3rd March—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in portable bedsteads and in sacking bottoms,—being a communication. Sealed 4th March—6 months for inrolment.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor-handles, inkstands, door-knobs, and articles where hardness, strength, and durability

are required,—being a communication. Sealed 4th March—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for improvements in compressing air and gases for the purpose of obtaining motive power,—being a communication. Sealed 10th March—6 months for inrolment.

Victor Hyacinthe Libert Guillouet, of Condé sur Noirot Calvados, in the Republic of France, chemist, for certain processes for increasing on manufactured fabrics the several shades of indigo. Sealed 10th March—6 months for inrolment.

Elijah Galloway, of Southampton-buildings, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in steam-engines. Sealed 10th March—6 months for inrolment.

Henry Alfred Jowett, of Sawley, near Derby, engineer, for improvements in railway brakes and carriages. Sealed 10th March—6 months for inrolment.

George Robins Booth, of Portland-place, Wandsworth-road, in the county of Surrey, for improvements in generating and applying heat. Sealed 10th March—6 months for inrolment.

James Murray, of Canterbury, in the county of Kent, barrack-master and captain, for improvements in saddlery and harness. Sealed 10th March—6 months for inrolment.

Thomas Horn, of Little Stanhope-street, Mayfair, upholder and decorator, for machinery or apparatus for cleansing carpets, matting, and similar fabrics. Sealed 10th March—6 months for inrolment.

Jean Baptiste Alphonse Brunet, of Paris, in the Republic of France, Gent., for improvements in the manufacture of coverings for roofs, walls, partitions, furniture, and other similar articles; and in boxes, tubes, and other hollow articles; and in the preparation or manufacture of materials to be employed for such purposes; and also in machinery to be employed in such or similar manufactures,—being a communication. Sealed 10th March—6 months for inrolment.

George Roberts, of Selkirk, in the Kingdom of Scotland, manufacturer, for an improved manufacture of certain yarns of linen, wool, silk, cotton, or other fibrous substances. Sealed 10th March—6 months for inrolment.

William Galloway and John Galloway, of Manchester, in the county of Lancaster, engineers, for improvements in steam-engines and boilers. Sealed 11th March—6 months for inrolment.

Jesse Ross, of Victoria-terrace, Keighley, in the county of York, Gent., for certain improvements in machinery and other apparatus for combing wool and other suitable fibrous substances; and in applying and working the same. Sealed 13th March—6 months for inrolment.

Thomas Dawson, of Melton-street, Euston-square, machinist, for an improved method of constructing umbrellas and parasols. Sealed 13th March—6 months for inrolment.

George Little, of New Peckham, in the county of Surrey, electro-telegraphic engineer, for improvements in electric telegraphs, and in various apparatus to be used in connection therewith; part of which improvements are also applicable to other similar purposes. Sealed 14th March—6 months for inrolment.

Herbert Taylor, of Cross-street, Finsbury, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes and strontia, sulphur, or sulphuric acid, from the sulphates of barytes and strontia; and for consequent improvements in the manufacture of carbonates and oxides of soda and potassa. Sealed 15th March—6 months for inrolment.

Richard Archibald Brooman, of the Firm of J. C. Robertson & Co., of Fleet-street, in the City of London, patent agents, for an improved method of manufacturing screws. Sealed 15th March—6 months for inrolment.

Herbert Minton, of Harts Hill, in the county of Stafford, Gent., and Augustus John Hoffstaedt, of Bridge-street, Blackfriars, in the City of London, Gent., for improvements in the manufacture of faces or dials for clocks, watches, barometers, gas-meters, and mariners' compasses, or other articles requiring such faces or dials. Sealed 17th March—6 months for inrolment.

James Hart, of Seymour-place, in the county of Middlesex, for improvements in the manufacture of bricks, tiles, and other articles made from plastic materials; and in the means of making parts of the machinery used therein. Sealed 17th March—6 months for inrolment.

Henry Bessemer, of Baxter House, Old St. Pancras-road, in the county of Middlesex, engineer, for improvements in the manufacture and refining of sugar, and in machinery or apparatus used in producing a vacuum in such manufacture; and which last improvements are also otherwise applicable for exhausting and forcing fluids. Sealed 20th March—6 months for inrolment.

Alexander Robertson, of Holloway, in the county of Middlesex, engineer, and James Glover, of the same place, roller, for improvements in the rolling and laminating of metals, and in the manufacture of metallic cases and coverings. Sealed 20th March—6 months for inrolment.

Matthew Herring, of Tonbridge-place, London, sugar-planter, for improvements in the manufacture of sugar and rum; part of which improvements are applicable to evaporation generally. Sealed 24th March—6 months for inrolment.

Frederick William Mowbray, of the borough of Leicester, Gent., for improvements in machinery for weaving. Sealed 24th March—6 months for inrolment.

George Guthrie, of Appleby, chamberlain to the Earl of Stair, and residing at Rephad, by Stranraer, in the county of Wigtown, for improvements in machinery for digging, tilling, or working land. Sealed 24th March—6 months for inrolment.

Thomas Hill, of Langside Cottage, near Glasgow, Scotland, Esq., for improvements in wrought-iron or malleable iron railway chairs. Sealed 24th March—6 months for inrolment.

Peter Armand le Comte de Fontainemoreau, of No. 24, Boulevart Poissonniere, Paris, in France, and 4, South-street, Finsbury, London, patent agent, for certain improvements in mills for grinding wheat and other grain,—being a communication. Sealed 24th March—6 months for inrolment.

Henri et Alexandre Six, of Wazemme le Lille, temporary, of Paris, France, Gent., for improvements in bleaching flax and hemp. Sealed 24th March—6 months for inrolment.

Hector Ledru, of 28, Faubourg Poissonniere, at Paris, in the Republic of France, civil engineer, for improvements in heating. Sealed 24th March—6 months for inrolment.

James Cheetham, jun., of Chadderton, near Oldham, in the county of Lancaster, cotton manufacturer, for certain improvements in the manufacture of bleached, colored, or party-colored threads or yarns. Sealed 24th March—6 months for inrolment.

David Farrar Bower, of Hunslet, in the county of York, manufacturing chemist, for certain improvements in preparing, rating (otherwise called rotting), and fermenting flax, line, grasses, and other fibrous vegetable substances. Sealed 24th March—6 moths for inrolment.

Edward Dunn, of New York, in the United States of America, but now residing at Montpelier-square, Brompton, in the county of Middlesex, master mariner, for improvements in reciprocating and rotary fluid-meters,—being a communication. Sealed 24th March—6 months for inrolment.

Samuel Holt, of Stockport, in the county of Chester, manager, for certain improvements in the manufacture of textile fabrics. Sealed 24th March—6 months for inrolment.

Samuel Walker, jun., of Birmingham, manufacturer, for a certain improvement or certain improvements in the manufacture of metallic tubes. Sealed 24th March—6 months for inrolment.

Thomas Hawkins, of Inverness-terrace, Bishop's-road, Bayswater, oilman, for improvements in brushes. Sealed 24th March—6 months for inrolment.

Henry Stephen Ridley, of Vincent-square, Westminster, surveyor, and James Edser, of St. James's-terrace, in the same City, builder, for a safety-hinge, and certain apparatus for the detection of burglars and prevention of burglaries. Sealed 24th March—6 months for inrolment.

Thomas Woods, of Portsea, in the county of Hants, upholsterer, and Robert Walter Winfield, of Birmingham, manufacturer, for certain improvements in bedsteads and couches, or articles for setting, lying, and reclining upon. Sealed 25th March—6 months for inrolment.

CELESTIAL PHENOMENA FOR APRIL, 1851.

D.	H.	M.	
1			Clock before the ☉ 4m. 4s.
	—		☽ rises 6h. 2m. M.
	—		☽ pass mer.
	—		☽ sets 6h. 9m. A.
	2	26	♀ in the descending node.
		34	☿ in conj. with the ☽ diff. of dec. 3. 51. N.
	6	33	Ecliptic conj. or ○ new moon
	10	8	☿ in sup. conj. with the ☉
2	2		♄ in conj. with the ☽ diff. of dec. 2. 53. N.
	13	59	♅ in conj. with the ☽ diff. of dec. 4. 49. N.
3	3	41	♃'s first sat. will im.
4	10	10	♃'s first sat. will im.
5			Clock before the ☉ 2m. 53s.
	—		☽ rises 7h. 32m. M.
	—		☽ pass mer. 3h. 2m. A.
	—		☽ sets 10h. 43m. A.
6			Occul. m Tauri, em. 8h. 11m. im. 9h. 14m.
7	10	16	☿ in conj. with ♄ diff. of dec. 2. 23. N.
	15	2	☿ in the ascending node
	—		Occul. χ^4 Orionis, em. 8h. 8m. im. 9h. 14m.
8	1	17	♃ in oppo. to the ☉
9	7	2	☽ in □ or first quarter
10			Clock before the ☉ 1m. 27s.
	—		☽ rises 11h. 39m. M.
	—		☽ pass mer. 7h. 38m. A.
	—		☽ sets 2h. 44m. M.
	0	45	♃'s second sat. will em.
	9	15	☿ in conj. with ♅ diff. of dec. 1. 5. N.
12	2	13	♃'s first sat. will em.
	4	38	☿ in Perihelion
13			Occul. b Virginis, im. 10h. 49m. em. 11h. 59m.
	6	0	☽ in Perigee
	8	41	♃'s first sat. will em.
14	7	49	♃'s third sat. will em.
	16	28	♄ in conj. with the ☉
	19	10	♃ in conj. with the ☽ diff. of dec. 3. 31. S.
15			Mercury R. A. 2h. 25m. dec. 15. 51. N.
	—		Venus R. A. 23h. 0m. dec. 7. 19. S.
	—		Mars R. A. 23h. 32m. dec. 4. 17. S.
	—		Vesta, R. A., 17h. 34m. dec. 16. 4. S.
	—		Juno, R. A., 17h. 52m. dec. 7. 50. S.
15			Pallas, R. A., 0h. 33m. dec. 1. 11. S.
	—		Ceres R. A. 2h. 27m. dec. 9. 20. N.
	—		Jupiter R. A. 13h. 5m. dec. 5. 18. S.
	—		Saturn R. A. 1h. 32m. dec. 7. 16. N.
	—		Uranus R.A.1h.52m. dec.11.1.N.
	—		Mercury pass mer. 0h. 53m.
	—		Venus pass mer. 21h. 28m.
	—		Mars pass mer. 21h. 59m.
	—		Jupiter pass mer. 11h. 31m.
	—		Saturn pass mer. 23h. 57m.
	—		Uranus pass mer. 0h. 20m.
	—		Clock before the ☉ 0m. 7s.
	—		☽ rises 6h. 23m. A.
	—		☽ pass mer. Morn.
	—		☽ sets 5h. 21m.
	8	35	☿ in conj. with Ceres, diff. of dec. 6. 44. N.
	10	35	Ecliptic oppo. or ● full moon
17			Occul. η Libra, em. 11h. 36m. im. 12h. 23m.
	—		Occul. θ Libra, em. 17h. 17m. im. 18h. 20m.
	3	21	♃'s second sat. will em.
18	8		Juno stationary
19	4	6	♃'s first sat. will em.
20			Clock after the ☉ 1m. 4s.
	—		☽ rises Morn.
	—		☽ pass mer. 3h. 43m. M.
	—		☽ sets 7h. 56m. M.
	10	35	♃'s first sat. will em.
	13	20	♅ in conj. with the ☉
21	11	46	♃'s third sat. will em.
22	11	28	♂ in Perihelion.
	12	39	☿ greatest hel. lat. N.
23	6	58	☽ in □ or last quarter
25			Clock after the ☉ 2m. 4s.
	—		☽ rises 3h. 2m. M.
	—		☽ pass mer. 7h. 48m. M.
	—		☽ sets 0h. 40m. A.
	4		☽ in Apogee
27	8	23	♀ in conj. with the ☽ diff. of dec. 2. 58. N.
	15	50	♂ in conj. with the ☽ diff. of dec. 3. 27. N.
	20	56	☿ greatest elong. 20. 31. E.
28	0	29	♃'s first sat. will em.
	4	48	Vesta stationary
29	15	44	♄ in conj. with the ☽ diff. of dec. 2. 56. N.
	23	55	♅ in conj. with the ☽ diff. of dec. 4. 49. N.

J. LEWTHWAITE, Rotherhithe.

THE

LONDON JOURNAL,

AND

REPERTORY

OF

Arts, Sciences, and Manufactures.

CONJOINED SERIES.

No. CCXXXIII.

ADDRESS.

Thirty years have now passed away since the commencement of this Journal, and sixty volumes of records of discoveries, appertaining to the arts and sciences, are the result of our labors. Of these discoveries by far the greater portion has found protection under letters patent,—the publication of the specifications of which was originally, and has, up to the present time, formed a prominent feature of the work. We are now, however, on the advent of a period which, from its unexampled character, seems to demand of us a special recognition; inasmuch as it presents, in a marked manner, a landing place in our progress to the culminating point to which our labors have ever tended; for, if we have done ought deserving remark, it has been to diffuse information respecting the many abstruse problems connected with the industrial arts,—the triumphant solution of which the assembled representatives of the world are about to commemorate. It is therefore our intention, for a short time, to depart from our usual practice of noticing the progress of invention, by reference to that unfailing source of information designated "recent patents," and to devote our attention to an analytical examination of those triumphs of mind over matter, which will be displayed in the Great Exhibition of the Industrial Products of all Nations. In doing this we feel that not only shall we be strictly following out the original design of this work, but that we shall be performing a duty, which the support received for so long a period from the manufacturing community in a measure imposes upon us. With the view, therefore, of carrying out this Herculean labor

in a manner commensurate with the expectations which the supposed facilities within our reach are calculated to give rise to, and, indeed, to do honor to the host of exhibitors, both British and Foreign, by putting on permanent record the state of the industrial arts in the year 1851, the services of several gentlemen, intimately acquainted with practical science, have been secured; who, together with our ordinary staff of contributors, will each examine the department with which he is most familiar. By thus bringing many discriminating minds to bear on the several departments of the Exhibition, it is confidently expected that, besides ensuring accuracy of detail in whatever is described, an effectual bar will be put to the inadvertent or ignorant notice of plausible mediocrity, to the exclusion of intrinsic merit. A further advantage, which it is hoped may arise from this arrangement, will be, that—by the collation of observations emanating from different minds, directed to one and the same object—many valuable hints may be offered to manufacturers for the improvement of one branch of the arts, by the adaptation thereto of some plan or process employed in another. It is almost needless to add, that not only will the department MACHINERY find its qualified representatives, but that CHEMISTRY as applied to the arts, RAW MATERIALS, DECORATIVE ART, and, in fact, every branch of industry, will also be fully and efficiently reported.

The plan which, on mature consideration, has been adopted, will differ widely from that which is suited to, and generally pursued by, the daily and weekly press; for, inasmuch as such publications are not intended for a permanent place in the library, their notices, although often copious, and prepared by men of undoubted talent, assume a sketchy or popular character; and are therefore serviceable only so far as they lead the reader to examine and judge for himself. Our intention is, on the contrary, to note the steps which have led to the present advance in the various branches of practical science, and to illustrate our remarks by instancing such appropriate examples as the Exhibition may afford; whereby we shall record the labors of the most meritorious exhibitors, while, at the same time, we are offering a series of essays on the industrial arts, which it is presumed may afford instruction to the general public, and not prove altogether unprofitable to the skilful practitioner.

RECENT PATENTS.

To CHARLES CADBY, *of Liquorpond-street, in the county of Middlesex, piano-forte maker, for improvements in stringed musical instruments.*—[Sealed 12th August, 1850.]

THIS invention relates to a novel mode of adapting the sound-board to piano-fortes; and also to a mode or modes of relieving the sound-board from the downward pressure of the strings; and it is equally applicable to all the various constructions of piano-fortes, and to other stringed musical instruments.

The ordinary mode of adapting the sound-board to piano-fortes is by glueing it to the heavy wooden framing of the instrument; and the effect of this is to destroy that brilliancy of tone which the strings are capable of producing. This defect the patentee considers to arise from the fact that the sound-board is not strained tight; and he has therefore devised a plan of effecting this object. According to this new arrangement, the sound-board is secured to the framework solely by metal clamps, in such a manner as to admit of its being strained or tightened when desired, and removed from the instrument when required. This is the case with the most approved construction of instruments; but, in the cheaper kinds of instruments, where economy is an object, the patentee glues the sound-board, at one end or throughout a portion of one end, to the wooden framing, as formerly, and sustains it at the opposite end by clamps, which admit of its being strained tightly, as in the former instance.

In Plate XIII., fig. 1, represents a front view, and fig. 2, a back view of the internal part of a cabinet piano-forte, constructed according to the present invention. A, is the sound-board, which is free all round, and is suspended at both ends by the clamps *a, a, a.* All the clamps at one end of the board, and some of them at the opposite end, are connected by screws and screw-nuts to metal bars B, B, B, which are bolted to the main framing. The remaining portion of the clamps *a, a, a,* are secured to the wooden framing, as at C, C, C.

When the sound-board is strained tight, an increased brilliancy of tone is the result. The clamps *a, a,* are shewn detached, and upon an enlarged scale, at figs. 3, and 4;—fig.

3, being a partial sectional view of one of the clamps used at the lower or bass part of the sound-board, and fig. 4, a partial section of another form of clamp, such as is shewn in fig. 1, at the upper or treble part of the instrument. They are precisely similar in principle of construction, although somewhat different in form. The clamp shewn at fig. 3, consists of two lugs 1, 1, which are connected to one end of a flat bar of steel 2; the opposite end of which terminates in a round pin 3, which is screwed and furnished with a nut 4, and washer. The two ends of the sound-board, whereby it is suspended, are provided, both above and below, with thin strips of wood *b, b, b,* as strengthening pieces. These pieces are firmly glued to the sound-board, and are embraced by the lugs 1, 1, of the clamps, and are further held by the screw or screws 6, which pass through the strengthening pieces and sound-board. The clamp shewn at fig. 4, being very similar in construction to that shewn at fig. 3, no detailed description thereof will be required. Both these clamps are furnished with screws and nuts, which admit of the sound-board being strained or tightened to any desired amount. The clamps *a*, a*, a*,* at the part C, C, are not adjustable: they merely consist of lugs attached to flat pieces of steel, which are secured to the main wooden framing, by screws or otherwise, as shewn at fig. 1. The sound-board is therefore held firmly by these clamps, while the straining or tightening process is effected by means of the tightening screws at the opposite side. It will be easily understood that, by means of these tightening screws, an immense strain can be put, not only on the sound-board, but on the framing, which has to resist the pressure of the bars B, B; and as this strain is all on one side of the framing, it has been found desirable to counteract the strain of the clamps *a, a, a,* by means of rods on the opposite side of the framing, as shewn at D, D, D, fig. 2. The ends of these rods are screwed and furnished with nuts *d,* and pass through holes made in the end upright posts of the wooden framing; so that by screwing up the nuts *d, d,* a counteracting strain, in opposition to that of the sound-board, is put on the framing, which will therefore preserve its original form. The rods D, are also made to rest upon the bridge-pieces *e, e, e,* which keep them back from the wooden framing, and allow the ends of the rods to have a fair pull, in opposition to the strain of the clamps. Vertical tie-rods E, E, are also employed to counteract the tension of the strings; but this forms no part of the present invention.

At fig. 5, the improved suspension principle is shewn, ap-

plied to the sound-board of a grand piano-forte. It will be seen, as in the former instance, that the sound-board is free or open all round, and is suspended at the two ends by clamps, with adjusting screws for straining it tight when required. The difference between this figure and those above described, being principally in form, it will not be necessary to enter into a detailed description thereof.

When the patentee permanently attaches the sound-board to the wooden framing, by means of glue or otherwise, in order to effect an economy, and yet retain the advantages resulting from his invention, it is the curved part marked c, c, c, fig. 1, which he permanently attaches to the wooden framing. A beneficial effect is produced, and the straining or tightening operation may be effected even when the sound-board is only semi-detached, as above explained; but in all superior instruments it is preferred to completely detach the sound-board, and merely suspend it from the framing by metallic attachment.

Instead of employing clamps with adjustable screws for suspending the sound-board, the inventor sometimes uses simple lugs, to the hinder part of which small pulleys or antifriction wheels 7, 7, are adapted, as shewn in the detached views, figs. 6, and 7.

In place of the adjusting screws and nuts of fig. 3, the inventor employs straight pins 8, 8, such as those used for holding the strings of the instrument. These pins are inserted in a wooden bar or beam E, which forms part of the framing, and a strong wire 9, is secured to these pins, and is made to pass round the antifriction wheels or pulleys 7, of the lugs; so that, by turning the pins 8, 8, the wire 9, is wound thereon, and, by pulling back the lugs, the tightening or straining of the sound-board is effected.

The sound-board is sometimes suspended at one end by non-adjustable metallic attachments, such as those shewn at c, c, figs. 1, and 2, or by connecting it to one single bar, extending the whole length of one end of the sound-board,—the adjustable clamps being all placed at the opposite end thereof.

It has been found by experience that the strain of the strings or wires, if not counteracted, will affect the sonorousness of the suspended sound-board. This deterioration in the quality of the tone of the instrument is due to the heavy pressure of the strings on the bridge-pieces, which are glued or secured on the upper side of the sound-board. To obviate this is the object of the second part of the invention.

It is well known that the strings of a piano-forte pass from the pin-plate to the bridge-piece on the sound-board, and

from thence across the sound-board to the tuning-pins at the opposite side. Now the bridge-piece is usually slightly elevated, so that, when the strings pass over it, they are bent out of a straight line; and, when the number of the strings is taken into consideration, it will be easily conceived that the amount of downward pressure on the sound-board is very considerable, and tends very much to restrict the freedom of its action. This objection the patentee meets, by causing every alternate string, or set of strings, to pull the sound-board upwards, instead of allowing all the strings to force or press it downwards. Several plans of effecting this object are shewn in the drawings; but reference to one will serve to explain the principle of action of all the arrangements.

Fig. 8, shews in section a part of the sound-board of a piano-forte, and some of the other parts adjacent thereto. A, is the sound-board; and *b*, is the bridge-piece for supporting the strings. This bridge-piece is, as usual, glued down on the face of the board; but, instead of all the strings passing over the top, and pressing it downwards, as is now the case, the bridge is made a little higher than usual, and the strings are passed through holes made therein, and from thence to the tuning-pins at the opposite end. One end of the strings is secured, as usual, to pins *p*, *p*, in the pin-plate E, and they are passed through holes made in T-pieces *t*, which are screwed into the plate E. The holes in the T-pieces are not on the same level, that is, one is higher than the other; so that when the strings or wires are passed through these, they reach the bridge at an angle, as shewn in the figure. It will therefore be seen that the lower wire will press the bridge *b*, downwards, while the upper wire will have a tendency to draw it upwards; and these two opposing forces being equal, the injurious downward pressure, above referred to, will be in a great measure prevented.

The patentee claims, First,—suspending the sound-board of piano-fortes, or other stringed musical instruments, by means of adjustable clamps,. screws, or other equivalent mechanical contrivances, whereby the sound-board may be strained or tightened when desired, and the brilliancy of the tone may be thereby increased. He also claims the use of the rods D, D, for the purpose of counteracting or resisting the tension of the strained sound-board on the wooden or other framing of the instrument. And, Secondly,—he claims the method shewn at fig. 8, or any mere modification thereof, for relieving the sound-board of piano-fortes or other stringed instruments from the downward pressure of the strings.—[*Inrolled February*, 1851.]

To CYPRIEN THEODORE TIFFEREAU, *of Paris, in the Republic of France, Gent., for certain improvements in hydraulic clocks.*—[Sealed 3rd October, 1850.]

THIS invention relates to certain improvements in hydraulic clocks, the principal feature of which consists in the use of a syphon, set on a float or "floating board," for the discharge of the water, whereby the passing of time is indicated.

In Plate XIV., fig. 1, is a vertical section of one of the improved hydraulic clocks. *a*, is the vessel containing the water, which is to be gradually discharged therefrom by means of the syphon *b*. One end of this syphon is affixed to a float *c*, which rests on the water in the vessel *a*; and the other end of the syphon descends into a tube *d*, in the centre of the vessel *a*, through which the water is discharged into the vessel *e*, that forms the base of the clock. By this means, the position of the discharging end of the syphon, relatively to the level of the water in the vessel *a*, will always be the same; and thus a uniform discharge will be ensured. A small cup or bowl *f*, is attached to each end of the syphon, in such manner that the same can be raised or lowered, for the purpose of regulating the quantity of water discharged in a given time. *g*, is a case which encloses the upper part of the syphon. A glass tube is attached to and communicates with the interior of the vessel *a*, so that the level of the water therein can always be seen; and the continual depression of such water-level (by the discharge of water through the syphon) may be caused to indicate the lapse of time by fixing a suitably-graduated scale at the side of the glass tube. Or the passing of time may be indicated by connecting a needle or index to the upper part of the syphon *b*, in such manner that, as the syphon descends, the needle will pass in front of a graduated scale on the exterior of the case *g*. Or a rack may be affixed to the top of the syphon and gear into a toothed wheel, the spindle of which carries an index or hand, placed in front of a circular dial, having the hours and minutes marked thereon; and thereby the descent of the syphon will cause the hand to travel round the dial and point out the time.

In order to refill the vessel *a*, when nearly the whole of the water has been discharged therefrom, it is removed from the vessel *e*, and placed on a suitable stand; and the water is then poured from the vessel *e*, into the vessel *a*, through an opening in the top of the latter, until it is level with the same hour or graduation at the upper part of the scale as that with which it previously coincided at the lower part of the same. The

water which is discharged through the syphon during the process of refilling must also be poured into the vessel *a*; and, after it has been observed to what extent it elevates the water level, double such quantity (as ascertained by referring to the graduations of the scale) must be drawn off by a small cock from the vessel *a*; as otherwise the time indicated by the apparatus would be proportionably behind the real time.

Fig. 2, is a front elevation of another improved hydraulic clock, and fig. 3 is a vertical section thereof, taken at right angles to fig. 2. *a*, is the vessel that contains the water to be discharged. *b*, is a syphon (shewn separately at fig. 4), one end of which passes through the top of the vessel *a*, and is fixed to the float *c*, and the other end descends into the tube *d*: in this case, the cups or bowls are dispensed with; and the quantity of water discharged by the syphon is regulated by a cock at *h*. The lower end of the tube *d*, is of a conical form; and from it the water drops into a funnel-shaped syphon *i*, carried by a lever *j*, which is provided at the opposite end with a counterbalance weight *k*. As the water accumulates in the syphon *i*, its weight depresses that end of the lever *j*, until it rests on the support *l*; then, on the level of the water in the cup of such syphon rising above the bend in the stem thereof, it will be caused to act in the ordinary manner of a syphon and discharge the whole of the water which it contains; and the weight at that end of the lever being thereby reduced, it will be raised again by the weight *k*. The alternating movements of the lever *j*, are communicated, by means of a cord or rod *m*, to a lever *n*, which turns on a pivot at *o*, and carries a click or driver *p*, that takes into the teeth of a ratchet-wheel *q*; so that such wheel will be caused to turn by intermitting impulses, corresponding with the oscillations of the lever *j*, (being prevented from running back by a pawl *r*,); and the motion of this wheel will be communicated by a suitable train of clockwork to the hands *s*, *t*, by which the time is pointed out upon the dial *u*.

It is stated that apparatus, constructed according to this invention, may be used for measuring the flow of liquids and the contents of vessels of different forms.

In conclusion, the patentee says, "I claim, as secured to me by the said recited letters patent, First,—the application and use of the syphon set on a floating board, producing a constant and regular flowing out of liquor, adapted to give the proper motion to an hydraulic chronometer or time-piece. Secondly,—I claim the application and use of the syphon-bowl, [*i*, figs. 2, and 3,] which is set flowing by the peculiarity

of its configuration, and gives directly a swinging motion by filling up and emptying itself, producing uniform intermitting strokes as hereinbefore described—which apparatus is also employed in the construction of another species of hydraulic time-piece. Thirdly,—I claim the application and use of the bowls or cups, which I adjust to both branches or arms of the syphon, and which, at the same time that they regulate the flowing out, keep up constantly the running-off action of the syphon. And, lastly,—I claim the application and use of all the several applications hereinbefore described."—[*Inrolled April*, 1851.]

To Alfred Vincent Newton, *of the Office for Patents*, 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in cutting types and other irregular figures,—being a communication.*—[Sealed 29th August, 1850.]

This invention relates to an improved arrangement of machinery whereby large types or letters may be cut or formed, in wood or other materials, with greater facility and expedition than is now the case. The machine whereby this is effected can also be employed for cutting various other kinds of irregular forms, either in wood or stone, and will be found peculiarly applicable for cutting tracery and gothic work, and all kinds of curved or excentric mouldings. It is also capable of cutting letters, forms, and figures, of various sizes, from the same pattern: that is, it may not only be employed, for producing an article of the same size as the pattern, but also facsimiles thereof on a reduced scale.

In this improved machine the cutting-tool is mounted in a stationary bearing, which is capable of adjustment in a vertical direction, to bring the tool to the proper position for operating upon the wooden block below. By this means the rotary motion of the cutting-tool is rendered much more steady and accurate than in the ordinary carving machines, wherein an excentric traversing motion is given to the cutter. The block of wood to be operated upon is secured upon a bed, which has a compound traverse motion imparted to it, for the purpose of enabling any part of the block which it carries to be brought under the cutting-tool. Besides this compound horizontal motion, the bed is, for some purposes, mounted in such a manner that it may be moved vertically in guides; as will be necessary for cutting or carving bas-reliefs, or figures with uneven or irregular surfaces; but this vertical motion is not

very frequently required for cutting such simple forms as types or letters. All the requisite motions are communicated to the bed by a rectangular frame, constructed upon the principle of the pentagraph, and consisting of four or more bars, jointed together, and connected at one corner to the bed, and carrying at the opposite end a tracer or point, which, when moved over the surface of the pattern, communicates a corresponding motion to the bed and block at the opposite end of the pentagraph. In addition to the horizontal pentagraph, abovementioned, there is also a second pentagraph, which, being placed vertically, and connected to the same centre, and the same part of the bed, as the horizontal pentagraph, will communicate to the bed and block a vertical motion, corresponding to the motion of the tracing-point at the opposite end of the pentagraph.

In Plate XIV., is exhibited a machine, which is applicable not only to the cutting out of types or letters, in wood or other materials, but also to the producing of various other irregular forms, such as gun-stocks, saw-handles, bas-reliefs, and other figures with irregular surfaces. Fig. 1, represents, in side elevation, the improved machine complete, and in the operation of cutting out a wooden type or letter; fig. 2, is a plan view; and fig. 3, is an end elevation of the same. A, A, is a table, to which the framing of the machine is firmly secured. An upright standard B, carries the bearing-frame C, in which the rotary stock *c*, of the cutting-tool *d*, is mounted. The bearing-frame C, is capable of a vertical motion in the guides *e*, *e*, of the standards; but its lowest position during the cutting or carving of any piece of work, is determined by a regulating-screw *h*, which works in a lug in the upper part of the standard B. The frame C, is capable of being raised (to lift the cutting-tool out of contact with its work) by means of a hand-lever *f*, which has its fulcrum at *g*: this hand-lever is connected to the frame C, by the screwed connecting-rod *h**. The block of wood *i*, to be operated upon, is secured to the sliding-bed D, by a screw-clamp *j*, which presses it tight against a shoulder or raised part of the bed. The bed D, has a horizontal motion longitudinally on the guides *k*, *k*, and a transverse motion on the guides *l*, *l*; so that, by this combination, a horizontal motion in any direction can be obtained. The moveable bed D, with its guides, is mounted on the upper end of a vertical T-piece *m*, *m*, which slides in vertical guides *n*, *n*; and the weight of the bed and its appendages is counterbalanced by a weighted rocking-lever *o*, *o*, the shorter end of which is inserted in a slot made in the T-piece *m*. The pat-

tern to be copied is secured by clamps and screws on an adjustable bed or plate E, which may be secured at any point along the long iron frame F. Four bars *p, p, p, p,* of equal length, and two shorter bars *p*, p**, constitute a horizontal pentagraph-frame; which has its centre of motion at G, and is connected at one end by a compound or universal joint to the sliding-bed D, and at its opposite end carries a tracing-point *q*, fig. 1: which point, as it is moved over the surface of the pattern, communicates a corresponding motion to the bed D, and block under the cutting-tool. In order that the tracing-point may be moved over the pattern with facility, the tracer-end of the pentagraph-frame is furnished with a hand-lever *r*, which is jointed at one end to the horizontal arm or lever *s*.

It will be seen that the rotary stock *c*, of the cutting-tool is furnished with a band-wheel or pulley, and that motion is communicated thereto by a band or strap *t*, from any prime mover. When the cutting operation is to be performed, the cutting-tool is caused to rotate; and, by means of the hand-lever *f*, it is brought down into contact with the block;—the proper distance for the frame C, to descend, having been previously regulated by the screw *h*. The tracing-point is now drawn round the edges of the pattern (supposing it to be a letter that is to be cut), and the pentagraph-frame is thereby caused to move the bed and block about under the tool in a corresponding manner; and thus a counterpart or copy of the pattern letter will be cut out on the block. For very simple work, only the above motions will be required; but for more elaborate work, such as bas-reliefs, gothic tracery, and similar articles, it is necessary that the bed D, and block should be capable of receiving a vertical as well as horizontal motion; and, for this purpose, the vertical pentagraph-frame *u, u, u,* is combined with the horizontal pentagraph-frame above described. This frame *u, u, u,* is connected to the same centre of motion G, as the frame *p, p,* and is also connected at one end to that joint of the frame *p,* which carries the tracer, and at the opposite end to the joint whereby the frame *p,* is connected to the sliding-bed D. It will be seen that the centre G, of the two frames *p, p,* and *u, u,* is so mounted as to allow these frames to rock when the tracer is moved over an uneven or undulating surface of the pattern. By this means the block on the bed D, at the other end of the pentagraph-frames, is not only moved horizontally, but is raised or lowered in a degree corresponding to the vertical motions of the tracer. It has been found, by experience, that in cutting out letters or flat surfaces it is most convenient to

follow the outline of the pattern; but, for bas-reliefs or irregular carving, it will be found advisable to trace straight across the pattern in horizontal parallel lines. In order to facilitate this operation, an adjusting screw *v*, is adapted to the back of the hand-lever *r*, fig. 2; and, by turning this adjusting screw an eighth, a quarter, a half, or a whole turn, after every traverse of the tracer across the pattern, the distance between the parallel lines traced by the point over the pattern, and those cut by the tool on the block, is regulated with facility and accuracy. A weight *w*, is connected by means of a cord to the end of the lever *r*, for the purpose of facilitating the working of this part of the machine. It will be evident to all persons conversant with the construction and use of pentagraphs, that by merely altering the position of the working joints 1, 2, 3, 4, and 5, along the bars of the pentagraph-frames, and placing the pins in other holes, the size of the article to be produced by the cutting-tool may be varied, without changing the pattern; and that, therefore, one large pattern of, for example, a wood letter, is all that is required for all sizes, from the largest to the smallest, of that particular letter. The mouldings or edges round the letter may also be considerably varied in appearance by merely changing the form of the cutting-tool. Athough, for the purpose of avoiding complexity in the drawings, but one cutting-tool is shewn, yet it will be obvious that two or more cutting-tools may be employed; as it will only be necessary to lengthen the bed, so as to receive an additional number of blocks, which will all be moved simultaneously by the same pentagraph-frame.

The patentee states that he does not intend to confine himself rigidly to the above arrangement or construction of parts, as they may be varied without departing from the nature and object of the invention. He claims, First,—the adaptation to the moveable bed D, (which carries the block or blocks to be operated on by the cutting-tool or tools) of an arrangement of levers constructed on the well-known principle of the pentagraph; whereby the motions of the said bed under the cutting-tool or tools may be made to correspond to the motions of a point or tracer over the surface of a pattern placed at the opposite end of the frame. Second,—the combination of the horizontal and vertical pentagraph-frames with a bed mounted in vertical as well as on horizontal guides, whereby not only a horizontal but a vertical motion may be communicated to the bed and block.—[*Inrolled February,* 1851.]

To Jacob Connop, *of Hyde-park, in the county of Middlesex, Gent., for improvements in melting, moulding, and casting sand, earth, and argillaceous substances, for paving, building, and various other useful purposes.*—[Sealed 10th July, 1850.]

At the commencement of the specification of this patent, the patentee says, "whereas, since obtaining the said letters patent, I have ascertained that the earth and argillaceous substances, mentioned in the title of the said letters patent, is not of sufficient utility to induce me to retain the exclusive use to the same under my said letters patent; and it is my intention, therefore, to obtain leave to enter a Disclaimer and Memorandum of Alteration of so much of the said title and letters patent as is expressed by the words earth and argillaceous substances." He proceeds to state, that the melting of sand with fluxes for making glass, and the casting and moulding of the same into various articles (chiefly for holding liquids and solids and for ornament), are well known; but the application of sand, when fused or melted with the other ordinary materials for glass-making, and when cast into suitable moulds and annealed, as hereafter described, as a manufacture applicable to the same purposes as the ordinary paving and building materials—such as paving slabs, bricks, blocks of various shapes, steps, shelves, and slabs, suitable for use in building houses or other works, where bricks or stones and marbles are now used; and such as rings, arches, inverts, or pipes, for drains and sewers and conveying liquids along streets and land—is new, and is the invention of improvements in melting, moulding, and casting sand for paving, building, and various other useful purposes, which he claims. The annealing process partially re-melts the moulded article, and converts the same into an opaque substance, of sufficient tenacity and freedom from brittleness to render it applicable to and useful for paving and building purposes.

The sand and accompanying fusing materials, used in carrying out this invention, are of a coarse and cheap description,—such as are suitable for making the commonest kind of glass; and the proportions thereof are those usually adopted in the manufacture of coarse glass of a dense character. The furnaces and pots are the same as those employed in making bottle-glass. The process of melting, both as regards time and fuel, is conducted as usual in manufacturing coarse glass. The implements for removing the melted materials from the pots, and for casting and pressing the same into moulds, are

to be of the ordinary description. The moulds are made of suitable shapes; and the melted materials are cast and pressed therein in the manner commonly practised in the manufacture of glass. The articles thus formed are to be carefully and thoroughly annealed in a suitable annealing oven. The patentee states, that he has conducted the annealing process in the following manner:—The articles, while yet in a soft and ductile state, are placed in an oven or kiln, heated to the same degree as the articles themselves; and they are surrounded with white sand, pounded chalk, or other cementing substance, in a heated state,—each article being kept separate from its neighbour. The articles are subjected to the action of a strong heat, approaching a white heat, for several hours; and when, on inspection, the glass is found to have changed in color to a dull drab, or brown, or white, the oven is gradually and carefully cooled down,—which will occupy about twenty-four hours. The oven should be of the shape and nature of a potter's oven, having only one chimney or outlet for the smoke: the patentee finds this form of oven to be best adapted to keep up an equal heat in all parts, and capable of being very gradually cooled down. When the articles are removed from the annealing oven, they will be found to be devitrified and fit for use as paving and building materials, and for sewers and drains, and for conveying liquids along streets and land.

The patentee states, that he does not claim the exclusive use of the several processes hereinbefore described and referred to, when taken separately, or except when employed in and for the manufacture of articles suitable for paving, building, and similar purposes; and he declares his invention to consist in the manufacture of articles, suitable for paving, building, and other similar purposes, from sand, by melting, moulding, casting, and treating the same as above described.—[*Inrolled January*, 1851.]

To Thomas Hoskins Howels, *of Amelia-row, Landport, Portsea, in the county of Hants, gunner, for improvements in gun-carriages.*—[Sealed 12th December, 1850.]

This invention consists in certain improvements in gun-carriages, for the purpose of mounting broadside guns, of any calibre or weight at present adopted in the royal navy, without the aid of slides.

In Plate XV., fig. 1, is a side view of a 68-pounder gun,

mounted on a carriage constructed according to this invention; fig. 2, is a plan view of the carriage; and fig. 3, exhibits a rear end view of the carriage, with the rear trucks as they would appear when training the gun "muzzle to the right." *a*, is the fore axletree of the carriage, provided with two trucks or wheels *b*. The rear axletree *c*, extends outwards to a greater distance beyond the sides of the carriage; and the projecting ends thereof have each a cylindrical hole or socket formed through the same, to receive the spindle or stem of the forked piece *d*, that carries the pin or axis of each hind truck *e*. The top of each spindle or stem bears against the under side of a lever *f*, which is connected to the rear axletree by a hooked pin *g*; so that when such levers are retained in the lowest position (as shewn at A, in figs. 1, and 2), by passing the same under the hook or catch *h*, the weight of the rear end of the carriage will rest upon the stems *d*, and consequently upon the trucks *e*; but when such levers are caused to assume the elevated position shewn at B, in figs. 1, and 2, by releasing the same from the catch *h*, and placing the outer end of each on the hooked support *i*, the weight of the rear end of the carriage will no longer be borne by the trucks *e*, (which are now, as it is termed, "detached,") but will rest upon the friction-plates *j*, which will then come in contact with the deck.

Gun-carriages, of this improved construction, possess a decided advantage over the common gun-carriages, when training; for the spindles or stems, revolving freely in the rear axletree, are instantly brought to the angle required to facilitate the training or running in or out (whereas the trucks of the old carriages impede the training); and they only require to be "detached" when firing with high charges, or in the case of weather guns, "when the ship has much heel," which is easily done by Nos. 3, and 4, [two of the men engaged in working the gun] when the gun is nearly "laid" for the object. After the gun has recoiled on the friction-plates, and is in the "loading position," at the order "load," Nos. 7, and 8, bear down upon the levers *f*, and force them under the catches *h*; and the weight of the rear of the gun will again be thrown on the rear trucks, ready for running out at the order. Should the levers, spindles, or rear trucks, be shot away, the carriage can be easily worked on the fore trucks and friction-plates,—using, if necessary, a roller hand-spike to assist in running out, or a common pair of wheels and axle, as at present.

The advantages resulting from constructing gun-carriages in the manner above described are, First,—that, as the ordinary

slides are dispensed with, the gangway is left perfectly clear for working the ship, except when the gun is run in for loading; Secondly,—that, as the improved carriages are of less weight than the common ones, the ports can be made closer together and more guns used in a broadside; Thirdly,—the guns are worked with less tackling and gear than usual; and, Fourthly,—they cost less than the common gun-carriages and slides.—[*Inrolled April*, 1851.]

To JOHN BEATTIE, *of Liverpool, in the county of Lancaster, engineer, for certain improvements in steering vessels.*—[Sealed 5th September, 1850.]

THIS invention consists in a peculiar construction of the rudder and some of its appendages, whereby the propeller may be placed beyond the rudder, by passing the shaft of the propeller directly through the rudder and through the stern-post, in the common line of the centre of the vessel.

The advantages proposed to be derived from this invention are a more free and perfect action of the rudder; the relief of the stuffing-boxes of the propelling-shaft from lateral strain; the prevention of the great noise and tremor which usually takes place from the rotation of what are called "screw propellers;" and the more efficient action of the propeller. This arrangement also admits of propellers of different diameters being adapted to the vessel.

In Plate XIV., fig. 1, represents, in side view, the rudder, with the propelling-shaft carried through the same. A, and B, indicate the rudder, formed in two parts, which are connected together by being firmly affixed to the rudder-post C, C. Through the middle of the rudder-post a hole is made, of the form shewn at fig. 2; which allows of the free action of the rudder when the propelling-shaft D, is passed through the rudder-post. A strong iron frame E, E, E, affixed vertically to the keel at the stern of the vessel, embraces and carries the rudder A, B, which is hung upon hinges or centres, and is worked by the ordinary apparatus above, attached to the top of the rudder-post C. The propelling-shaft D, D, connected to the working parts of the steam-engine within the vessel, is to be carried straight in the line of the vessel through a stuffing-box in the fore part of the stern-frame,—through the divided parts of the rudder,—and through and some distance beyond a bearing in the hinder part of the stern-frame. To the outer end of the propelling-shaft, the boss F, (carrying

the vanes or paddles G, G,) is to be keyed; and which (being altogether on the outside of the frame) may be attached or detached with the greatest facility.

It will be understood that by this construction and arrangement, the rudder may be worked to any obliquity without interfering with the propelling-shaft or the propeller; and the greatest effect of the propeller may be obtained under all positions of the rudder,—owing to the propelling-vanes being removed to a situation beyond the rudder and stern-post,—and thereby relieved from the friction and resistance of the water, which would otherwise be operating against their efficient propelling force.

The patentee claims the so forming the rudder that the shaft of a screw or spiral propeller may be passed through the rudder and rudder-post, for the purpose of placing the rudder before the propeller, and thereby effecting an improvement in steering vessels.—[*Inrolled March*, 1851.]

To JULIAN BERNARD, *of Buchanan-street, in the City of Glasgow, N.B., artist, for improvements in pneumatic springs, buffers, pumps, and stuffing-boxes.*—[Sealed 4th October, 1850.]

THIS invention relates to the application of a flexible tube or tubes in the construction or formation of springs, buffers, pumps, stuffing-boxes, and other mechanism; and it consists in the adaptation of such flexible tubes so that one or both ends of the tube shall fold inside or outside the remaining length of tube, in such a manner as to offer peculiar facilities for expanding or contracting the space within the tube, when used as a transmitting cylinder or for other purposes.

Two examples are given of the application of this invention —first, to a hydrostatic press, and, secondly, to a buffer for a railway carriage.

In Plate XIII., fig. 1, is a vertical section of a hydrostatic press, constructed according to this invention. *a*, is a metal cylinder, which is used, with the flexible tube *b*, in place of the ordinary cylinder of a hydrostatic press. It is cast open at the ends; at the top there is a flange *c*, which rests upon two beams or bearers *d*, that form the base of the press; and at the bottom, which is also flanged, the cylinder is enlarged conically. The flexible tube *b*, is made, by preference, of vulcanized India-rubber. It is securely held at the lower end between the inner surface of the cylinder and the exterior

surface of the conical piece *e*, (shewn separately at fig. 2,) which is formed with a flange *f*, whereby it is bolted to the lower flange of the cylinder *a*: grooves are formed around the conical piece *e*, and around the inner conical surface of the cylinder *a*, for the purpose of obtaining a firmer hold of the flexible tube. The other end of the tube *b*, is drawn over the conical end of the ram *g*, and a ring *h*, with a conical inner surface, is placed over it; and then, by applying the set screw *i*, and conical washer *j*, the end of the tube is securely fastened. *k*, is a pipe, by means of which water is forced into the tube *b*, through an opening in the conical piece *e*, provided with a valve *l*.

In fitting the parts together, the end of the ram is passed through the tube *b*, until it reaches the end of the tube; and such end is then attached to the ram by means of the ring *h*, screw *i*, and washer *j*; The ram is now drawn back so as to turn the greater part of the tube inside out, as represented at fig. 1; and the other end of the tube is then secured between the conical part of the cylinder *a*, and the conical piece *e*. To put the press in operation, water is forced into the tube *b*, through the pipe *k*, and, by pressing against the lower end of the ram, and within the annular space formed by the bending of the tube *b*, it forces the ram upwards. When it is required to relax the pressure, the water is discharged by opening a second valve in the conical piece *e*. The use of the cylinder *a*, is to guide and support the tube *b*, which receives the water used for working the press; and which tube, by preventing the water from coming into contact with the cylinder *a*, removes any chance of leakage, and renders it unnecessary to have a stuffing-box on the cover a^1, of the cylinder, for the ram to work through.

Fig. 3, is a longitudinal vertical section of the improved buffing-apparatus. *a*, is a metal cylinder, which is affixed to the under framing of the railway carriage, behind the end rail thereof. *b*, is a flexible tube, which is fastened at one end to the cylinder by the conical piece *e*, and at the other to the conical end of the buffer-rod *m*, by the ring *h*, set screw *i*, and washer *j*, as at fig. 1; but in this case the screw *i*, is bored to receive a rod *n*, which is secured to the end-piece *e*, and projects through the screw *i*, into the hollow buffer-rod, so as to serve as a guide to the buffer-rod in its movements. When the tube *b*, has been secured to the buffer-rod, that rod is moved back until the head of the screw *i*, nearly touches the end-piece *e*; and then the annular space (produced by the folding of the tube *b*,) is filled with water or other liquid

through an opening in the piece *e*, furnished with a valve. The buffer-rod being now drawn out, the water assumes the position shewn by the dotted line; and air, to fill the remaining space within the tube *b*, is admitted by the valve *l*,—the air being either at the ordinary pressure of the atmosphere, or at a higher pressure. The object of using the water or other liquid is, that, as the same is incompressible, the end of the buffer-rod can never be forced back so far as to come in contact with the end-piece *e*,—which might take place if the tube *b*, contained air only.

Pneumatic springs may be made on this principle for various other useful purposes. Flexible tubes, turned or folded in the manner described, are also applicable, when fitted with proper inlet and discharge-valves, as air or water-pumps;—the tubes being either enclosed in metal or other cylinders or cases, or left uncovered. When employed for air-pumps, water may be admitted into the tubes for the purpose of displacing any air contained therein; so that, in its action in expelling air during pumping, the supply of air taken in at each stroke will be entirely expelled. In all the arrangements, the turning in or folding-over action of the flexible material of which the tubes are made allows them to act as substitutes for the ordinary stuffing-boxes; and the same adaptation of flexible tubes may be used for a great variety of purposes where a rod or other body is to be passed air or fluid-tight through any other body.

The patentee claims, as his invention, the application and use of flexible tubes, turned in or folded over, for the purposes hereinbefore described.—[*Inrolled April,* 1851.]

To Alfred Vincent Newton, *of the Office for Patents,* 66, *Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in couplings for carriages, and in the attachment of wheels to axles,—being a communication.*—[Sealed 28th May, 1850.]

This invention consists, firstly, in a means of connecting the front axletree of a carriage to the parts to which the body is attached; secondly, in an improved method of attaching the whipple-tree to the pole or to the shafts; thirdly, in an improved manner of attaching and arranging the "bows," by which the top or "calèche" of a carriage is raised or lowered; fourthly, in an improved method of connecting the wheels to the axles; and, fifthly, in an arrangement of the springs, by which

they are made to connect the parts of the wheels which receive the shocks, in moving onward, with those parts which play upon the axles.

The first part of this invention consists of what the inventor terms a "fifth wheel," for coupling the fore axle and the perch of a carriage; and it is also adapted to connect the trucks of railway carriages with the body of the same, as well as for various purposes of like nature.

In Plate XV., fig. 1, is a longitudinal vertical section of the axle, bolster, and connexions; fig. 2, a transverse vertical section of the same; fig. 3, a view of the face of the lower plate; and fig. 4, a view of the face of the upper plate. This coupling is composed of two circular plates *a, b,* so formed that, by one movement, they can be interlocked and form an union, which admits of the "ring-bolt" being dispensed with. The plate *b,* consists of a disc, having at its centre a recess or depression, as shewn; and around its edge a rim is thrown up, terminating in a narrow flange, projecting inwards, as shewn at *c, c.* The flange has likewise two notches cut into it, as seen at *d, d;* and the plate may have ears *e, e,* cast upon it, for the purpose of readily securing it to the bolster or other proper part of the carriage to which it may be applied. The under plate is also a disc *a,* whose diameter is such as will allow it to pass within the flanges *c, c.* In the centre of this is a recessed space a^1, having a rim projecting a little above the surface of the plate. This forms an oil-cup for lubrication when the plates are joined, as shewn in section at fig. 1. Upon the plate *a,* two projections c^1, c^1, are cast, of a suitable size to pass into the notches *d, d,* of the flange in the upper plate. To make the connection, it is only necessary to pass the projections c^1, c^1, through the notches *d, d,* and then turn the lower disc partly round, which will bring the projections under the flange, and secure the two discs together, until the projections are again brought opposite to the notches. The lower plate is bolted, or otherwise firmly affixed, to the upper side of the axle, in such position that the projections on it coincide with the notches on the upper plate,—when one of the wheels is taken off, and that end of the axletree is turned back under the carriage in a line parallel with the perch. In this position only can the two be separated or be made to interlock.

The second part of this invention consists in so connecting the whipple-tree to the carriage, that, without interfering with the required freedom of motion, the danger which usually results from a trace breaking or becoming unhitched is pre-

vented,—the whipple-tree retaining its appropriate position when only one trace is attached, and thereby allowing the horse to continue drawing as before. On the under side of the whipple-tree *f*, (fig. 5,) is a plate or disc of suitable metal, *g*, having, near the outer edge a flange *h*, rising from it, and in the centre a circular projection *i*, rising to one-half the height of the flange. From this central piece to the flange there are pieces *k*, *k*, cast on the plate *g*, and opposite to each other. Each of these must occupy somewhat less than one-fourth the area of the plate within the flange, in order to allow the required play or traverse of the whipple-tree. On the upper side of the cross-bar of the shafts, f^1, fig. 6, is a plate or disc g^1, having at the outer edge a flange h^1, rising to the height of the flange *h*, and of such size as will enclose that within it. At the centre of this disc is also a projection *i*, of the same size as that on the other plate; and there are also two pieces *k*, *k*, cast on the plate and solid with it, of the same size as those on the plate *g*, and consequently extending only so far from the centre as will leave between them and the flange h^1, a recess for the flange *h*, when the plates *g*, g^1, are applied together. Through the centre of each plate a hole *l*, is made, for the bolt which attaches the whipple-tree to the cross-bar. When the plate, shewn at fig. 5, is properly connected with that shewn at fig. 6, the projections *k*, *k*, on the upper plate, will lie in the spaces between the projections *k*, *k*, of the under plate, and, *vice versâ*, the surfaces *i*, *i*, come into contact, and the flange h^1, encloses the flange *h*. A bolt may now be passed through the holes *l*, *l*, to secure the plates together. The plates and wood-work attached may now have a vibrating motion on the bolt, by so much only as the projections do not fill the entire area of the circle. If now one trace or tug be detached from the whipple-tree, the other will continue to draw by the bolt through *l*, and the interlocking of the projections on the upper plate against those on the lower plate.

The third improvement in couplings for carriages consists in a method of connecting the bows, by which the moveable top or calèche is held in a raised position. By this means a person sitting in the carriage is enabled to lock or unlock the bows when the top is elevated. On the ordinary seat (fig. 7,) of a carriage, having the usual extension top, there is a shaft *m*, of metal, running along the back, behind the cushion, and extending, at each side, far enough beyond the seat to form the usual journals for the bows. This shaft is secured near each end in boxes m^1, so that it may have a vibratory motion.

Bows *n*, of common construction are used; but, instead of having the usual play on the journals m^2, they are firmly keyed to the shaft *m*. Motion being now given to the bow on one side of the top, it is communicated through the shaft to that on the other side. To the shaft is attached, by welding or otherwise, a bar *o*, in such a position that, when the top is elevated, the bar shall lie along the side of the seat inside of the leather covering of the top; and by the use of this bar the occupant can lock or unlock the bows, at pleasure, from the inside.

The fourth part of the invention consists in an improved method of connecting the wheel with the axle; whereby the wheel may be readily taken off without the removal of any parts, such as nuts or linch-pins; as the use of these in attaching the wheel to the axle is dispensed with entirely. A hook, terminating in a spring (as seen at *p*, fig. 8,), is let into the axle: the inner end of the box has a groove *q*, cut around it, in which the hook at the end of the spring plays. The removal of the box cannot therefore be effected, unless the spring is raised, so as to withdraw the hook from the groove: this is to be accomplished, when desired, by pressing up a bolt p^1, which passes through the axle.

A modification of this part of the invention is shewn at figs. 9, and 10, in which the position of the parts is merely reversed,—the groove being cut on the axle, and the springs and hooks being placed on the inner end of the box. Fig. 9, is a longitudinal section of the parts combined; and fig. 10, is a plan of the inner end of the hub. *p*, *p*, are hooks, hinged at one end of each to the box, and kept in place by springs, as shewn; and, instead of the bolt for withdrawing them, a collar *r*, is put around the hub-band, having small projections, at opposite sides, on the inner face of the ring; which projections engage each an end of one of the hooks. The whole is covered in by an annular plate r^1, which admits of the axle being passed through it. When the collar *r*, is moved round in the direction of the arrow (fig. 10,) the projections will cause the hooks to open, and the wheel may then be drawn off from the axle.

The fifth part of the invention relates to a mode of connecting those parts of the wheels of all vehicles used for locomotion which encounter or receive the shocks, in moving onward, with those parts which play upon the axles. These connections are so made as materially to arrest all shocks, received by the wheel at the circumference, before they reach the axle. This effect is obtained by inserting in the hub of the wheel

some permanently elastic substance, as India-rubber, or compounds of like character, or elliptical, spiral, or corrugated springs of steel. The hub is formed by making a ring *s*, fig. 11; the inner circumference of which comes in contact with the elastic material, but its outer circumference (when the wheel is constructed with spokes) is furnished with a series of mortice holes, to receive the inner ends of the spokes. The box may be of any of the usual forms, but it must be of sufficient length to allow of a screw-thread being cut on its outer end. On the inner end of the box is a broad flange, forming a disc *t*, cast solid with it, and of a diameter nearly equal to that of the ring *s*. Another disc t^1, of similar size, is attached to the box, at the outer end, by being screwed upon it, as shewn; and these two discs are brought just so near to each other as to close upon the ring *s*, but not so tightly as to impede its free motion. The inner face of each disc is turned out to give them a dish-shape, for the purpose of affording room for the elastic substance within the ring to expand laterally, when subjected to a compressing force. *u*, is a ring of India-rubber, which surrounds the box *v*, and fits the ring *s*. A metal washer *x*, is inserted next to the ring of India-rubber, and between it and the back plate *t*;—its use being to regulate the degree of elasticity in the elastic ring; and for the purpose of operating upon the washer *x*, and adjusting its position, screws *y*, *y*, are provided, which pass through the disc *t*, as shewn. It will now be seen that the elastic material sustains the load and rotates with the wheel;—thus interposing constantly a spring nearest to the plane where the concussions are given.

The patentee claims—Firstly, in relation to the method of connecting the front axletree with the other parts of the vehicle, and for other purposes—the plate *b*, affixed to the lower side of the bolster, and made to interlock with the plate *a*, affixed to the upper side of the axletree by means of the flange *c*, the notches *d*, *d*, and the projections c^1, c^1, in the manner set forth. Secondly—in relation to connecting the whipple-tree to the carriage—the stops or blocks *k*, *k*, *k*, *k*, cast upon or otherwise affixed to the plates *g*, g^1, in such manner that, when the two are joined by a central bolt, they may interlock, with the privilege of a certain amount of play or traverse, as herein described. Thirdly—in relation to attaching the bows—the combination of the shaft *m*, and operating-bar *o*, with the bows *n*, for the purpose of locking or unlocking the said bows in the manner described. Fourthly—in relation to connecting wheels to axles—the hook *p*, with

its spring and bolt, in combination with the groove q, on the axle, or the equivalents of either and all of them, as before described. Fifthly—in relation to connecting those parts of wheels which receive the shocks with those parts which play upon the axles—the introduction, within the hub, of springs to resist and destroy the shocks and concussions caused by the rolling of the wheel on uneven surfaces; also the combination of the discs with the box or axle and the other parts of the wheel for forming the spring-chamber, and as a support to the wheel; and likewise the means of regulating the elasticity of the springs, in the manner herein set forth.—[*Inrolled November*, 1850.]

To SELIM RICHARD ST. CLAIR MASSIAH, *of Alderman-walk, New Broad-street, in the City of London, for improvements in the manufacture of artificial marble and stone, and in treating marble and stone.*—[Sealed 10th August, 1850.]

THE patentee manufactures artificial marble and stone by subjecting the material known as gypsum, or sulphate of lime, or alabaster, to the following processes:—The material having been cut or prepared of the desired shape, it is placed in a drying-room, heated to from 80° to 100° Fahr.; when thoroughly dry, it is immersed in a warm solution of borax and sal-enixum [supersulphate of potash], prepared by adding about one pound of borax and a quarter of an ounce of sal-enixum to each gallon of water; and, on being removed from the solution, it is again placed in the drying-room. When dry, it is exposed to a temperature of 250° Fahr., or upwards, until the watery parts are entirely driven off; after which, it is taken out of the oven or stove, and, to prevent decrepitation, it is permitted to cool till the hand can be borne on it for a few seconds; and then it is immersed in a hot saturated solution of borax, to which concentrated nitric acid is added, in the proportion of from a quarter of an ounce to an ounce thereof to each gallon of the solution: it is essential that the best and most concentrated nitric acid be used, as much of the hardening and bleaching depends upon it. The solution is kept in a simmering state, or nearly so, until the material is saturated; then it is taken out and allowed to dry; and, when dry, it will be found to have acquired a marble-like hardness. A day or two after this operation, it is gently heated, and Canada balsam, diluted with turpentine or naphtha, is applied thereto: it may be kept warm until the spirit

is driven off; or the spirit may be driven off by exposure to the air.

The patentee obtains simple colored marble by operating as above described, but substituting for the solution of borax and nitric acid, a solution of borax accompanied by a dye and nitric or other acid, or a nitrate: for example, to produce blue marble, a solution of borax with indigo and nitrate of iron may be employed.

To produce a compound colored marble, a double process is necessary: for example, the material is first prepared of a blue color, in the manner above described; when dry, it is subjected to the second process of heat, above mentioned; it is permitted to cool, as before, to prevent decrepitation; and is then immersed in a solution of borax containing safflower, or any red dye, and nitric acid,—whereupon the blue and red colors separate and form apparently natural streaks or veins, partaking of purple tints in some places, and in others preserving the red and blue veins apart and unblended. This process may be repeated with other dyes, so as to obtain three or more colors.

The patentee states, that he does not confine himself to the use of borax and sal-enixum, as alum or other earths may be used. He claims the employment of nitric acid in the white and naturally-veined marbles, and the mode of obtaining the compound colors, which may be tripled and quadrupled by multiplying the process.

The patentee submits old, inferior, or decrepitating marbles to the above process, and thereby strengthens and dyes them. He claims the process when applied to these purposes.—[*Inrolled February,* 1851.]

To Theodore Cartali, *of Manchester, in the county of Lancaster, merchant, for certain improvements in the treatment or preparation of yarns or threads for weaving, —being a communication.*—[Sealed 14th June, 1850.]

This invention consists in submitting yarns or threads to an extra twisting operation, after they have been produced in the ordinary manner by the mule, throstle, or other machine commonly used for such purpose;—the object being to put into the yarns or threads such an amount of twist as will give them a tendency, when woven, either as weft or warp, into a fabric, to snarl up by the application of moisture, and by such tendency necessarily contract the surface of the fabric, and

give it a pleated and puckered appearance. The machinery used for so preparing yarns or threads may be of many of the ordinary constructions, and the order of proceeding may be somewhat varied; but the course of operation which it is preferred to adopt is the following:—The cops of yarn or thread to be prepared are taken, say, from the mule, and bleached by any of the ordinary methods, and placed upon the creel of a machine, precisely similar to that used for the process of doubling; and before leaving the delivery-rollers, they are passed through a trough of water. In this moist state the yarns or threads have the extra twist put into them by the action of the flyer, and are wound upon the ordinary bobbins; and they may next be converted into hanks, or any of the usual forms of arranging yarns: the additional twist afforded them by the improved process being latent or nearly so, and, when woven (by any ordinary machinery for that purpose), there is little difference in the appearance of the cloth compared with that of the present manufacture, as long as the fabric remains dry. Upon the application, however, of moisture in the process of washing, the yarns, which have undergone the improved preparation or treatment, contract in length, and, by drawing with them those with which they are interwoven, the face of the cloth is disposed in a wrinkled or pleated form. The amount of additional twist given may, of course, be varied, according to the amount of contracting power required, and may be regulated by the relative speeds of the rollers and flyers, as is well understood. Instead of treating the yarns or threads so as to cause them (previously to the extra operation of twisting) to pass through water, they may be conveyed through a jet of steam; or both may be dispensed with, and they may be prepared in a dry state: in which case, however, the extra twist imparted to them will not be so latent, but the fabric, which they wholly or in part constitute, will contract in some measure on its removal from the loom. The use of moisture, however, is preferred; and it will be evident that this may be applied to them in a variety of ways,—either by saturating the cop or bobbin in the whole, or by wetting the yarns or threads as they pass through the machine. Instead of bleaching the yarns or threads before they undergo the improved preparation, they may be so treated when in the grey state; but in such case it is preferred not to bleach the material until it is woven, as the tendency of such process is to curl up the yarn, so as to prevent its easy application to the loom. When throstle-spun yarn is used for the improved preparation, it may be wound from the bobbins into

a suitable form for being bleached, and then treated as described; or it may receive the additional twist in a grey state, and be bleached in the cloth.

The patentee claims the submitting of yarns or threads to an additional operation of twisting, after they have been manufactured by the mule, throstle, or other spinning-machine. —[*Inrolled December,* 1850.]

To THOMAS PAGE, *of Middle Scotland-yard, in the county of Middlesex, civil engineer, for improvements in the construction and means of cleansing sewers.*—[Sealed 1st June, 1850.]

THIS invention consists in a mode of constructing the outer ends of sewers, to facilitate the discharge of sewage or other foul liquid matter, and thereby to cleanse the sewers by the agency of the tide or other waters against an adverse head of water, at such stage of the tide as may be most suitable for such discharge, by causing an equal quantity of clean or ordinary water to take its place; which latter may be discharged at any after time, when the discharge of the sewage or other foul liquid matter would be objectionable and offensive.

In Plate XIII., fig. 1, is a plan view, and fig. 2, a vertical section of the outer end of a sewer, constructed according to this invention. *a,* is a reservoir, communicating with the river or sea, into which the sewage is to be discharged, by means of the sluice *b,* which is to be so situated that the reservoir may be filled with water at the level of high water. *c,* is another reservoir, sufficiently capacious to contain the sewage which will flow into it from the conducting sewer *d,* during the time that elapses between the successive discharges of such reservoir; and it is formed at such a height that, while the sewer *d,* may be freely drained, the sewage contained in the reservoir may be above low-water level. *e, e,* are culverts or covered channels, which form a communication between the reservoir *c,* and the river or sea; the ends of the culverts next the river are closed by sluices *f,* and the ends next the reservoir *c,* by sluices *g*; and the culverts also communicate with the reservoir *a,* by sluices *h,* placed as close as practicable to those communicating with the reservoir *c.*

Now suppose all the sluices to be closed, the reservoir *a,* filled with water by the flood-tide or other suitable means, the culverts *e,* filled with sewage, and the time to be that state of ebb-tide at which it is desirable the sewage should be dis-

charged—say about an hour after high water. The sluices *f*, and *h*, being simultaneously opened, a free communication is established between the reservoir *a*, and the culverts *e*, and between these culverts and the river; so that the sewage in the culverts will be exposed at the end *h*, to the pressure of the water in the reservoir *a*, and at the end *f*, to that of the river; and as the former pressure is necessarily greater than the latter (in proportion to the fall of the level of the river since high water), the sewage will be forced into the river with a velocity due to the difference of the level of the water in the reservoir *a*, and that in the river. When the sewage has been entirely driven out by the water from the reservoir *a*, the sluices *f*, and *h*, are closed; and nothing further is required to be done until the time of low water;—during which interval the sewage brought down by the culvert *d*, accumulates in the reservoir *c*.

At low water the sluices *f*, and *g*, are simultaneously opened, so as to establish a free communication between the reservoir *c*, and the culverts *e*, and between the culverts and the river; the sewage in the reservoir *c*, will then, owing to its superior pressure (resulting from the difference of level before mentioned), drive the water from the culverts into the river; and as soon as this has been effected, and the culverts are filled with sewage, the sluices *f*, and *g*, are closed. The apparatus is now in the state first described, except that the reservoir *a*, is empty. By repeating the above process at every ensuing tide, the discharge of the sewage is effected at any state of tide which may be desirable, without any auxiliary mechanical power beyond that derived from the varying level of the water in the river, although at such time the level of the sewage to be discharged may be many feet below that of the river into which it is caused to flow.

In the above description, the varying level of the water into which the sewage has to be discharged is assumed to be occasioned by the tides; but the invention is equally applicable in all cases where such variations occur, whatever may be the cause thereof. The supply of water for the reservoir *a*, may likewise be derived from other sources than the river or sea; as from neighbouring springs or streams.

The patentee states, that he is aware that the descent of large bodies through a small fall has been made, by a mechanical arrangement, to raise a smaller body of water to a greater height, and that a small stream of water, falling from a considerable height, has, by similar means, been made to raise a larger quantity to a less height. He therefore claims

neither of these methods, but only using a body of clean water to discharge sewage or foul water against an adverse head;—which water can be afterwards discharged instead of the sewage, as soon as the water has fallen sufficiently, and when the discharge of the sewage would be objectionable. In the term sewage he includes any liquid which, in consequence of foreign impurity, it may be desirable to discharge only under certain circumstances, or at certain times. He does not confine himself to the peculiar form or arrangement of the several parts, as the same may be varied: thus, for example, the reservoirs may be divided into several parts; or the culverts may be made to merge into one channel; or the sluices may be made self-acting. He merely claims the general combination or arrangement by which he is enabled to discharge the sewage at any time of tide, without any mechanical aid other than that derived from the varying level of the water itself, in the manner above illustrated.—[*Inrolled December*, 1850.]

To CHARLES HARRATT, *of Royal Exchange-buildings, in the City of London, merchant, for improvements in rolling iron.*—[Sealed 28th September, 1850.]

THIS invention consists in rolling iron bars from piles or fagots produced by coiling or winding a rod or bar around a bundle of rods or bars, so as to lay the fibres of the iron in varied directions, and thus obtain iron bars of greater strength than usual.

The apparatus employed by the patentee in piling or fagotting the iron rods or bars is represented in Plate XV.,—fig. 1, being a plan view; fig. 2, a longitudinal section; and fig. 3, a transverse section thereof. *a*, is the framing of the machine; *b*, is a bundle of rods or bars, which are held together by twisting a piece of stout wire around each end thereof; and *c*, is the rod or bar, which is being coiled or wound around such bundle. The centre rod of the bundle is shorter than the rest, so as to form a recess at each end for the reception of the conical ends of the shafts *d*, d^1, by which the bundle is supported during the operation. The shaft *d*, is formed with a screw-thread around it, working in a corresponding female screw in the framing *a*, so that, on turning such shaft, by means of the handle *e*, it will be caused to advance or recede, for the purpose of retaining or releasing the bundle of rods. The shaft d^1, carries, near one end thereof, a disc *f*, with a stout pin *g*, projecting therefrom;

and at the other end it is provided with a toothed wheel *h*, which is connected, by other wheels, with a steam-engine or other first mover. *i*, is a lever, which is attached to and slides along a fixed bar or rail *j*, and carries an adjustable guide *k*, for laying the rod *c*, around the bundle of rods. *l*, is another guide, bolted to a carriage *m*, which travels along one side of the frame *a*,—being provided with small wheels or rollers to run in the longitudinal groove in the top of the side rail of the frame. In the upper surface of the carriage a groove or channel is formed for the rod *c*, to pass through; and to the end of the carriage is hinged a lever *n*, which can be pressed down by the workman upon the rod *c*, for the purpose of offering a resistance to the delivery of that rod, and thus causing it to be coiled tightly around the bundle.

When the bundle of rods *b*, has been placed in the machine, and securely supported by the conical ends of the shafts d, d^1, the end of the rod *c*, is attached thereto by means of the clamp *o*, shewn detached, in side and edge views, at figs. 4; and the shaft d^1, being then put in motion, the pin *g*, will come in contact with the end of the clamp, and thus cause it and the bundle of rods to revolve with the shaft d^1. By this revolving movement the rod *c*, is gradually coiled around the bundle *b*;—the coiling and delivery of such rod being regulated by the parts *i, k, l, m, n*. When the whole of the bundle *b*, is covered by the coils of the rod *c*, the latter is severed; and the pile or fagot, thus produced, is then removed from the machine and converted into bars of the desired section by the ordinary processes of heating, rolling, &c.

The number of rods in the bundle, and the number of coils or convolutions, or series of coils or convolutions, of the rod around such bundle, may be varied, as is shewn at figs. 5, which represent, in transverse section and side view, a pile or fagot, consisting of a bundle of seven rods or bars *b*, with a rod *c*, wound around the same in three series of coils. Although the rods or bars have been mentioned as circular in their transverse section, they may be of any other section, as is exhibited at figs. 6, which represent a pile or fagot suitable for being rolled into a railway bar.

The patentee says he is aware that iron rods have heretofore been twisted in the manufacture of gun-barrels (but not around a bundle of rods); he does not therefore claim the twisting of iron rods; but what he claims is, the manufacture of iron by rolling rods or bars piled or fagotted as hereinbefore described.—[*Inrolled March*, 1851.

To George Dunbar, *of Paris, Esq., for improvements in suspending carriages.*—[Sealed 23rd July, 1850.]

The object of this invention is to suspend carriages from the axle by flexible bands, chains, braces, straps, or cords.

In Plate XV., fig. 1, is a side elevation of a two-wheeled carriage, suspended according to this invention; and fig. 2, is a side elevation of another carriage, the mode of suspending which differs somewhat in the details; but, in both cases, a band, chain, brace, strap, or cord, on either side of the carriage, is attached to the axle *a*, and the carriage is suspended from such axle by means of the bands, chains, braces, straps, or cords; and hence, in both cases, the suspending of the carriage is by flexible means. In fig. 1, on each side of the carriage, there is what may be called a double strap, cord, or band *b*, fastened at the centre to the axle; and the position of the parts is adjusted by means of a screw-bolt *c*, and nut *d*, connected with the lever *e*, to which the flexible strap, cord, or band, is attached. In fig. 2, the flexible suspending bands are adjusted by means of barrels *f*, which are provided with suitable ratchet-wheels and catches or pawls, for the purpose of retaining the same in any required position.

The patentee states, that he does not confine himsef to the above details, so long as the peculiar character of his invention be retained; and he likewise states, that the form of the carriage, to which the invention is to be applied, may be varied, according to the object for which it is intended to be applied. He claims, as his invention, the means, hereinbefore described, of suspending carriages.—[*Inrolled January*, 1851.]

To James Hamilton Browne, *of the Reform Club, Pall Mall, Esq., for improvements in the separation and disinfection of fecal matters, and in the apparatus employed therein,—being a communication.*—[Sealed 10th October, 1850.]

This invention consists, first, in certain disinfecting agents; and, secondly, in separating the liquid from the solid matters contained in cesspools, privies, &c., and filtering and clarifying such liquid matters, while the solid matters are thereby rendered applicable as manure.

The patentee commences by stating that the chemical disinfecting agents hitherto employed do not effect the desired

object: for example, the sulphate of peroxide of iron has been recommended as a suitable agent for counteracting the disengagement of free sulphuretted hydrogen in privies; whereas, by the use of this salt, the evil sought to be remedied is rather increased; for, in consequence of its acid nature, large quantities of sulphuretted hydrogen and carbonic acid gases are disengaged, and a great deal of froth and scum are thereby caused to accumulate on the top of the matters under treatment. The agents and processes employed by the patentee are as follows:—He uses impure binoxide of tin (which may be purchased at a low price) to combine with or neutralize the sulphuretted and phosphuretted hydrogen gases. Or he employs for this purpose the subsulphate of peroxide of iron (represented by the formula $SO^3Fe^2O^3+6HO$), which does not contain an excess of acid, but, on the contrary, being basic, as well as peroxidized, completely destroys the sulphuretted and phosphuretted hydrogen gases, and prevents froth and scum (the presence of which indicates a want of success in disinfecting operations); and it likewise neutralizes the carbonate and hydrosulphate of ammonia, which are the only other fetid gases known to arise from privies and cesspools. Any neutral metallic salt may also be used to fix any gases other than free sulphuretted and phosphuretted hydrogen; and either the binoxide of tin or subsulphate of peroxide of iron may be subsequently introduced to decompose the two gases before mentioned, viz., the carbonate and hydrosulphate of ammonia. The saturation or neutralization of the above-named metallic salts may also be effected by the use of the ammoniacal water of the gas-works. By increasing the proportion of ammoniacal water, the non-permanent carbonates and hydrated oxides of iron, zinc, &c., would be precipitated, and a good disinfectant obtained. By mixing subsulphate of iron, or stannic acid, or oxichloride of tin with some cheap oleaginous matter, a solid disinfecting agent, or one in a state of paste, is produced: three or four parts of this paste would neutralize or fix the fetid gases contained in a thousand parts of fecal matter. The chloride of calcium, which is obtained as a residuum in the manufacture of gelatine from bones, makes a good disinfectant; for which use it is prepared by neutralizing all excess of acid, either by lime or ammoniacal gas liquor; the metallic salt being then added, sulphate of lime, in a very divided state (which will fix the ammonia of urine) and neutral protochloride of iron are produced; and besides, by the combination of these substances with the chloride of calcium, a deposit of phosphate of lime is caused to

take place, which increases to a great extent the richness of the fecal matters when converted into manure.

The patentee states that the influence of oleaginous matters in the instantaneous disinfection of putrid matter and excrement has not been sufficiently studied, nor has the action of fatty bodies upon sulphuretted hydrogen: for example, it has always been supposed that common oil only tended to cover the fetid matters, and thus, as it were, to imprison the gases; whereas it also acts as a disinfecting agent. He further states that, being convinced of the highly disinfecting powers possessed by the carburets of hydrogen, he has endeavoured to discover the means of turning their use to good account; for oil and fatty matters have been hitherto employed without any regard to economy; in fact, people have proceeded no further, in many cases, than to throw a few quarts of oil over the matters in a cesspool or privy. This course of proceeding is attended by the following disadvantages:—first, the difference of specific gravity prevents a mixture taking place; and secondly, the oil only covers the upper layer of matter in the privy, and does not act on the matter in the lower part thereof. To overcome these disadvantages, the difference of specific gravity between fatty matters and excrement must be adjusted, and the surface for the fatty or oily matters to act upon must be increased.

To effect these objects, a disinfecting fluid, "holding an oily substance in solution and very finely divided," is prepared by mixing some hundredth parts of oil or fatty matter with water, which, to facilitate the union, should be rendered slightly alkaline by the addition of potash, or soda, or putrified urine, or ammoniacal gas liquor, &c. A "white, opalescent, and lactiform fluid" is thus produced, which (in order more readily to adjust the difference of specific gravity) it is preferable to use in combination with one of the metallic salt solutions above described; and then wherever the metallic salts penetrate, by reason of their superior specific gravity, the oily matter will accompany them. When it is desired to increase the density of the lactiform fluid without employing the metallic salts, which cause a change in the appearance and color of the fecal matters, the patentee substitutes therefor a saline solution or the chloride of calcium obtained in the manufacture of gelatine from bones,—which, being acid, must be first neutralized. The chloride of calcium, resulting from the manufacture of soda, might likewise be used for the same purpose; and the patentee also proposes to employ, in some cases, with the lactiform fluid, certain residuums of the ma-

nufacture of stearine, the liquid remaining after the washing and cleansing of wool, and the residuum of the operation of purifying oils: this liquid may be used either alone or with metallic or non-metallic salts.

Organic matters, while fermenting, are in a state of continual movement, resulting from the transformation of a portion of the solids into gases; and in this process of transformation there is an absorption of heat, without which neither fermentation nor putrefaction can take place. This motion of particles (produced by fermentation and by the gases, resulting therefrom, having a tendency to pass off) is more visible when the fermentable matters contain a quantity of liquid; as in the case of solid fecal matters mixed with urine: thus, in a privy the particles are always in motion when above a certain temperature. The patentee describes certain means of arresting this fermentation and of expediting the precipitation of the matters held in suspension. He states that the fermentation will be arrested by the introduction of one or other of the disinfecting agents before described (other known disinfectants may also be used for this purpose), and that the precipitation and separation of the matters so treated will be facilitated by the disinfectants before mentioned. They generally produce a metallic sulphate, which, by its superior gravity, causes the more rapid descent of the organic matters held in suspension: this, in some cases, occupies several days; but in general it is effected in a few hours. The liquid is then drawn off by any suitable apparatus, and either dispersed over the fields or thrown away; and the solid matters at the bottom of the privy are taken out to be immediately converted into inodorous manure. If the liquid, extracted from the privy, has not been allowed sufficient time to settle, then, before being thrown away or put into reservoirs, it is passed through a filter, formed, by preference, of carbonaceous substances. To the pipe that conveys the liquid to the filter, or the one that conducts it from the filter, is connected a small tube, which communicates with a vessel on a higher level, containing the disinfecting liquid; so that if the disinfectant, which was thrown into the privy, has not penetrated everywhere and rendered the disinfection complete, it may be made more perfect before the liquid is thrown away. More rapid and perfect clarification may be effected by means of any compound of alumina, particularly the double sulphate of alumina and of potash, or the impure sulphate of alumina.

Another method of disinfecting consists in extracting the matters from the privy and disinfecting them in their passage

through the pipes therefrom. In Plate XV., is shewn a vertical section of a cesspool or privy *a*, containing the fecal matters to be treated; *b*, is a pipe through which the matters are withdrawn therefrom by means of a pump; *c*, is a vessel containing the disinfecting liquid; *d*, is a tube that connects the vessel *c*, with the pipe *b*; and *e*, is a tap for regulating the quantity of disinfecting liquid that is allowed to flow into the pipe *b*, whilst the fecal matters are being pumped up through the same.

The patentee states that, by adopting one or other of the above processes, the subsequent manufacture of the matters into manure is more economical and rapid, and there will be less loss of ammoniacal substances than when any other means is adopted. A mixture of the solid fecal matters with some dry carbonaceous powder would ensure a rapid conversion of the fecal matters into a powdery and permanently inodorous substance,—say in fifteen days in summer and a month in winter.

The claims made by the patentee are, First,—the separating of the liquid from the solid parts of fecal and putrid matters, and the disinfecting of fecal and putrid matters, by means of any of the metallic salts hereinbefore described, whether employed by themselves, or in conjunction with the lactiform fluid hereinbefore described. Secondly,—the lactiform fluid hereinbefore described, for the purpose of disinfecting fecal and putrid matters. Thirdly,—the disinfecting of fecal matters, while being withdrawn from a cesspool or other receptacle, by means of the apparatus hereinbefore described.—[*Inrolled April*, 1851.]

Scientific Notices.

PATENT LAW AMENDMENT BILLS, Nos. I & II.

A CRITICAL examination of the provisions of the two rival Bills now before Parliament, for the reform of the Patent Laws, might be thought premature, and perhaps prove wholly useless, inasmuch as they have been carried to their present stage more for the purpose of eliciting information on the subject, through the instrumentality of a Select Committee, than for ensuring the ultimate passing of one or other of the Bills. It may, however, be well to state, concisely, the substance of these Bills, in order to shew what amount of

reform the inventive community may expect from the present movement. The following is the substance of the first of these proposed measures, which was presented to the House of Lords by Lord Brougham:—A permanent Commission is to be formed, composed of the Lord Chancellor, the Master of the Rolls, the Attorney and Solicitor-General for England, the Lord Advocate and the Solicitor-General for Scotland, and the Attorney and Solicitor-General for Ireland. Of these, three are to form a quorum (the Lord Chancellor or the Master of the Rolls being one of that body), with power to make, from time to time, such regulations as may be thought advisable for the issuing of letters patent, and of disclaimers and memorandums of alterations, and for the filing, preservation, and publication of the specifications. Patents are to bear date from the day when the application is made; and the application is to be referred to and reported on by such person or persons as the Commissioners may appoint; and every report recommending the grant of letters patent shall be accompanied by a written description of the invention sought to be protected. On the production of this report the Commissioners will order a warrant to be made out, which shall be sufficient authority for the sealing of the patent; such patent to extend over the United Kingdom, the Channel Islands, and the Colonies. Patents will become void at the end of the third and seventh years, unless the sums hereafter mentioned are paid up when due. Enrolment of all specifications and disclaimers shall be at one office, into which all those contained in other offices shall be collected. Copies of specifications and disclaimers shall be open for public inspection, but the originals shall be recorded. The Queen's printer shall print and sell, at reasonable prices, the specifications of all patents. The owner or part owner of a patent shall have power to enter a disclaimer to the same, as if he were the original patentee; the same to be valid notwithstanding the want of concurrence of other parties interested in the patent. In any actions for the infringement of a patent, the plaintiff shall state the grounds of complaint; and defendant, on pleading thereto, shall deliver with his pleas, and the prosecutor, in any proceeding of *scire facias*, to repeal letters patent, shall deliver with his declaration, particulars of the objection on which he means to rely at the trial; and no other evidence shall be received in court, without cause being shewn to, and permission allowed by, a judge at chambers.

The following are the fees proposed to be levied:—

On leaving petition for grant of letters patent ..	£10	0	0
On warrant for sign manual	8	0	0
On filing specification of patent	2	0	0
Stamp duties receivable—			
On granting letters patent	10	0	0
Additional stamp duty, due on the expiration of the third year from date of patent	40	0	0
Ditto on the expiration of the seventh year	70	0	0

Earl Granville's Bill bears a strong family resemblance to the one just described. In this instance also a Commission, composed of the law officers of the Crown, is to be appointed, to regulate the proceedings with respect to the granting of patents, and all matters relating thereto. Applications for patents are to be made at the Secretary of State's Office, accompanied by a description of the invention sought to be protected; and every such application is to be referred to the Attorney or Solicitor-General for his Report. The date of the patent may bear date from the day of application, if the Attorney or Solicitor-General think fit; and these officers are to have power to reject applications, when not accompanied with a proper description of the invention sought to be protected. The same authority as in the former Bill is to be sufficient for sealing letters patent, which may extend to the whole of the United Kingdom; but patents for Scotland and Ireland will be granted as heretofore, if required. Patents are to lapse on non-payment of certain fees hereafter enumerated. The prior knowledge and use of an invention abroad to vitiate a British patent for the same. The deposit of a provisional specification, together with the payment of two pounds, to give protection for six months; and a second payment, of twenty pounds, to give a further security for six months,—the provisional specification being then made the permanent specification.

The fees payable on patents and specifications are as follows:—

On leaving petition for grant of letters patent ..	£2	0	0
On warrant for sign manual	5	0	0
On filing specification	2	0	0
Stamp duties receivable—			
On granting letters patent	10	0	0
Additional stamp duty, due on expiration of the third year from the date of the patent	40	0	0
Ditto on expiration of the seventh year	70	0	0

To which is to be added the Attorney-General's fee on granting Report.

We reserve our comments for the amended Bill, which we trust will be brought up by the Select Committee soon after the close of their sitting.

ON THE EMPLOYMENT OF HYDROGEN IN THE ANALYSIS OF MINERAL COMPOUNDS.

BY M. L. E. RIVOT.

(*Continued from p.* 287).

[Translated for the London Journal of Arts and Sciences.]

Separation of oxide of iron from zircona.—The separation of these two bases by the reducing power of hydrogen on the peroxide of iron, is effected with the same facility and exactness as that of iron from alumina; indeed, the result obtained by weighing the residuary zircona is even more accurate, as this earth possesses less levity than alumina, and is therefore less likely to be carried off in the gaseous current; it is also admissible, in dissolving out the reduced iron, to employ a stronger solution of nitric acid, as zircona, after calcination, is quite insoluble in acids. The following mixture was submitted to experiment:—

Peroxide of iron	gr. 0·668
Zircona	„ 0·377

The following results were obtained:—

Loss of weight in hydrogen	gr. 0·205
Corresponding to peroxide of iron	„ 0·667

Weighing afterwards both zircona and peroxide of iron, they were found to indicate—

Peroxide of iron	gr. 0·668
Zircona	„ 0·375

These numbers prove that the separation of the two oxides by the proposed means is very exact, and that the composition of the mixture may be confidently deduced from the loss resulting from the action of the hydrogen, reckoned as the oxygen of the peroxide of iron. This process is more rapid and exact than any other in present use.

Separation of oxide of iron from glucina.—This separation, conducted with similar precautions to those employed in the separation of iron from alumina, will give results equally satisfactory; but glucina, like alumina, may, in some slight degree, be carried off in the current of hydrogen when its quantity is considerable. When, therefore, there is a large proportion of glucina, the composition of the mixture cannot be deduced from the loss of weight in the hydrogen only,—the iron must be dissolved out of the residue by means of weak cold nitric acid. The dilute acid employed must not contain more than one part of acid to 30 of water. The following mixture of oxide of iron and glucina was analyzed:—

Peroxide of iron	gr. 0·815
Glucina	„ 0·399

The result was—

Loss of weight in hydrogen	gr. 0·249
Corresponding to peroxide of iron	„ 0·812

The mixture of metallic iron and glucina, afterwards treated with dilute nitric acid, gave—

Peroxide of iron	gr. 0·816
Glucina	„ 0·397

This process is, therefore, evidently very applicable to the separation of oxide of iron from glucina. The separation of the earth yttria from iron has not been tried by this method.

The reducing action of hydrogen upon the oxides of cobalt and nickel may also be usefully employed to separate those metals from alumina. When an acid solution, containing cobalt and nickel, with alumina, is saturated with ammonia, the precipitate retains a certain quantity of the oxides of cobalt and nickel; but the precipitate of alumina may be obtained quite pure by calcination and after treatment with dry hydrogen gas, as above described; as the reduced metals may then be dissolved out by means of dilute nitric acid, which leaves the alumina unaffected.

Separation of oxide of tin from silica.—The reducing power of hydrogen may be used with advantage to separate tin from silica. The following is the method of operating:—The mixture of tin and silica, strongly calcined and weighed, is placed in a little vessel of porcelain, also accurately weighed; and this is then introduced into a porcelain tube, placed in a furnace (as was explained formerly). The current of hydrogen is now passed through the tube, but so slowly as not to carry off any of the silica; and the temperature of the tube need not exceed a moderate red heat. The reduction of the oxide of tin is effected very rapidly. After the whole has cooled in the atmosphere of hydrogen, the mixture of metallic tin and silica is found in the state of a grey powder without any metallic globules, unless the temperature were too much raised, or the oxide of tin not quite pure. When weighed, the loss gives the amount of oxygen; from which may be calculated the quantity of oxide of tin, and, consequently, the composition of the mixture. As the silica may, however, have been carried away in minute quantity by the current of hydrogen, it is advisable to dissolve out the tin in aqua regia, and then weigh the undissolved silica. When the weight of the silica does not correspond with the composition indicated by the loss of weight in the hydrogen, it is well to estimate the tin itself from its solution in aqua regia. The best process for estimating the tin is as follows:—First saturate the acid solution with ammonia; then add sufficient sulphide of ammonium to re-dissolve the sulphide of tin at first formed; decompose the sulphur salt, thus formed, by means of hydrochloric acid; and the sulphide of tin will be precipitated. This must be collected on a filter, and well washed and dried; and, after being submitted to a careful roasting, it is converted into oxide of tin,—in which state it may be weighed. The following mixtures were analyzed:—

	1.		2.
Oxide of tin	gr. 0·310	......	gr. 0·500
Silica	„ 0·644	......	„ 0·500

Results—

Loss of weight in hydrogen ...	gr. 0·69	gr. 0·106

Calculating the oxide of tin from these numbers, the composition of the mixtures should be—

	1.	2.
Oxide of tin	gr. 0·324	gr. 0·509
Silica	„ 0·630	„ 0·491

In this we perceive a notable error,—the estimation of the tin being too high in both cases. Treating the residue with aqua regia, and estimating the tin by the method described above, the quantities of tin and silica were—

	1.	2.
Oxide of tin	gr. 0·307	gr. 0·497
Insoluble silica	„ 0·636	„ 0·496

These quantities prove that the error arises from reckoning, as the oxygen of the oxide of tin, a certain proportion of the loss of weight in hydrogen, which arose from the removal of a small portion of the silica in the gaseous current. It is, therefore, only in cases in which the quantity of silica is very small, that its loss in the current of hydrogen can be neglected. When the quantity of silica is greater, it would be always necessary to estimate the tin itself, and calculate the quantity of silica by the difference.

Tin ores.—Ores containing oxide of tin may be analyzed very quickly and readily by means of dry hydrogen. When the ore, well pounded, is heated gradually in a current of dry hydrogen, the oxides of iron and tin are completely reduced. The time required to effect this is about an hour and a half for one or two grammes of the ore. The compound is allowed to cool in the hydrogen; and, when weighed, will shew the loss which has occurred from the removal of the oxygen in combination with the iron and tin. By treating the residue with aqua regia, the iron and tin will be dissolved out, leaving the gangue unacted upon. The latter may be analyzed by the ordinary means. The solution of iron and tin is saturated with ammonia, and a great excess of sulphide of ammonium added, to re-dissolve the sulphide of tin. The whole is allowed to digest together for about 12 hours; and it is then filtered. The sulphide of iron, well washed with water containing sulphide of ammonium, is afterwards converted into peroxide of iron. The sulphide of tin, dissolved in sulphide of ammonium, is precipitated by acetic acid, and converted into oxide of tin by roasting,—the process being conducted with great care. The weight of peroxide of iron and binoxide of tin indicate the weights of the metallic iron and tin rendered soluble in acids by the action of the hydrogen; whilst the loss of the weight of the mineral in the current of gas gives the amount of oxygen combined with the two metals, and furnishes data for the estimation of their state of oxidation. The table which follows shews the result of an analysis of schlich of tin from Piriac:—

Weight of the compound submitted to the action of hydrogen	gr.	1·1795
Loss of weight = oxygen	„	0·1235
Weight of gangue insoluble in aqua regia	„	0·5650
Iron dissolved in aqua regia	„	0·1310
Tin dissolved in aqua regia	„	0·3624

These quantities give, for the composition of the tin schlich, as follows:—

Iron	gr.	0·1110
Tin	„	0·3081
Oxygen (combined with the iron and tin)	„	0·1047
Gangue	„	0·4790
	gr.	1·0028

It may be remarked, that the iron, tin, and combined oxygen, bear to each other the relation of—

Iron	4 equivalents
Tin	5 „
Oxygen	12 „

The author remarks here, that he has no desire, by this investigation, to deduce any hypothesis as to the chemical formula of native oxide of tin. Some specimens of crystallized oxide of tin were about to be submitted to analysis, in the hope that they would point out the state of oxidation of the iron and tin in these compounds. The above analysis is quoted only with the object of shewing the facility of the method of analysis, and the rapidity with which the iron and tin can be estimated in mineral substances by this plan.—[*Annales de Chemie et de Physique.*]

ON THE PRESERVATION OF MILK.

The preservation of milk for the use of ships and travellers is an important problem of the present day.

One of the earliest processes employed to condense milk, and to bring it into a state in which it could be easily preserved for a considerable length of time, was pointed out by M. Braconnot. In this method, 3 or 4 litres of milk are to be placed over a gentle fire and gradually brought up to a temperature of about 40° Cent.; into this is poured, very cautiously and drop by drop, hydrochloric acid, diluted with thirty times its bulk of water. The acid will immediately cause the milk to coagulate. The clot is then to be removed from the whey or fluid portion, and is allowed to drain; after which, it must be again placed over the fire,—5 or 6 grammes of powdered crystallized carbonate of soda having been first mixed with it. A thick creamy substance is produced by this process. To this cream an equal weight of white sugar is to be added; and for use it must be diluted with about eight times its weight of water. Thus prepared, it affords a very passable kind of milk.

In another process, the freshly-coagulated portion of skimmed milk is taken, and, after being pressed, is placed over a gentle fire and mixed with bicarbonate of soda, in the proportion of 3 grammes of the latter to the kilogramme of caseous matter; the water is then evaporated by heat, gradually and carefully applied; and the residue of the evaporation is a tenacious gluey substance. This is partly dried; then cut into slices; after which, the drying is completed. Dissolved in boiling water, this substance affords a liquid very similar to milk.

In Paris, they sell, under the name of *galactine*, a thick fluid, prepared in the following manner:—Fresh unskimmed milk is coagulated by means of strong vinegar; the clot is well washed, purified, and pressed; it is then placed over a very gentle fire and mixed with sugar of milk, previously prepared by the addition of a little bicarbonate of soda and powdered gum tragacanth. The mixture coagulates under the form of a kind of cream; and it is then poured into bottles, where it afterwards becomes more consistent and gelatinous as it grows cold. It is stated, that a spoonful of this cream, mixed up with tepid water, produces a very tolerable substitute for milk. Indeed, these methods produce neither more nor less than a modification of natural milk.

It has been long known that milk, evaporated by boiling to a small fraction of its original weight, became a pasty substance, easily preserved, and having a saccharine taste, somewhat similar to that of honey, which, when it was mixed with water, gave it again very much the character and flavor of the milk from which it was prepared.

In 1826, M. Malbec obtained a patent in France for a new process of preparing and preserving milk. This method consisted in evaporating the milk, lightly skimmed, mixing with it the sixth of its weight of white sugar. The evaporation is conducted in a bason over a water-bath. During the time of the evaporation the milk is kept constantly stirred with a wooden spatula; and the application of the heat is maintained until a small quantity of the mixture, when allowed to cool, becomes hard and brittle. The whole is then allowed to cool, and is packed in lead, or closely-stopped jars. It is said that milk thus prepared may be kept for a whole year; and that, dissolved in water, it is of an excellent flavor. To prepare it for use, it is heated with water over a gentle fire, in the proportion of six tablespoonsful of the dried milk to about thirteen ounces of water.

M. de Villeneuve, formerly an officer of the French navy, manufactured the preserved milk in the solid form, in small blocks. Some of these were exhibited in the expositions of industrial products in the year 1844.

M. Martin de Lignac was, however, the first person to carry out this invention on anything like a practical scale. Living in a district where the milk is abundant and of excellent quality, he has established a manufactory, in which he prepares milk for

the use of the navy. The following is the process which he employs according to the specification of his patent:—The apparatus used in this process consists of a large pan of sheet-copper. This pan is placed within a second and larger one, which contains water, and which is intended to be used as a water-bath. In the bottom of the outer pan is coiled a tube, pierced with a great number of small holes. This tube is in communication with a steam-boiler; the steam from which, issuing from the little holes, heats the water in the outer copper pan. The inner pan, for containing the material to be operated on, being heated up to 100° Cent., the milk, in its natural state, without being skimmed, is poured in (it ought not, when in the pan, to exceed a centimetre in depth); 75 grammes of white sugar, in powder, are then added for every litre of milk; and, during the whole process, the fluid is carefully stirred with a wooden spatula to hasten the evaporation, which generally requires about two hours. When the milk is reduced to one-sixth of its original volume, and has been brought to the thickness of honey, the steam is shut off from the water-bath, and the thickened milk stirred violently for four or five minutes; after this it is transferred to a copper, heated up to the temperature of boiling water; lastly, the concentrated milk is put into cylindrical tin boxes, of which the covers are fastened down by a strip of lead which surrounds them. The boxes, thus closed, are left in repose for 24 hours; and the strip of lead is then soldered down to hermetically seal them. The sealed boxes are next placed in an apparatus, in which they are subjected to a boiling temperature for ten minutes or a quarter of an hour. The preparation of the milk is then completed.

To render the condensed milk fit for use, it is heated in five or six times its bulk of water, until it assumes the consistency and appearance of milk in its ordinary state. The solution resembles, in every respect, milk of the best quality; and it possesses, without the addition of sugar, a precisely similar taste, and, at the same time, is equally nutritious.

Milk preserved by the above process has been submitted to experiments at Toulon and Brest, which prove its applicability to the purposes of shipping. It must be observed, that the manner in which the cows are fed, and the nature of their food, exercises a strong influence upon the condition of the milk, and, consequently, upon the quality of the preserved compound; it has therefore been found advisable to carry on the process of preparation only in the spring and summer, when the abundance of fresh and green food ensures a superior quality of milk. From the experiments instituted upon this subject by the Commissioners of the "*Academie des Sciences*," the following results have been obtained:—

1st. The concentrated milk mixes readily with tepid water, and then becomes more opaque and milky. By the addition of four times its bulk of river water, a liquid is obtained which pos-

sesses exactly the average composition of normal milk: this mixture with water may be heated to 100°, and boiled, without experiencing any perceptible change.

2nd. Employed in the preparation of tea, coffee, or chocolate, in the usual manner, it will be difficult to distinguish it from ordinary milk boiled and sweetened.

3rd. If the box, containing the prepared milk, be left open for six or eight days, without any of the substance being removed, the surface of the pasty matter will become yellow, and may contract a slight degree of rancidity; but it is only necessary to scrape away a thin coat from the surface to entirely remove the part which has undergone modification.

Means have been proposed to preserve milk in the liquid state. A plan, invented by M. Appert, has been long used successfully with this object. The chemist Kirchoff also proposed to reduce milk to the state of dry powder, which was afterwards mixed with a certain proportion of water. This method has not, however, been found successful.

INSTITUTION OF CIVIL ENGINEERS.

March 25th, 1851.

WILLIAM CUBITT, Esq., President,—in the Chair.

The paper read was,—*On the improvement of the navigation of the river Newry.* By Sir John Rennie, M. Inst. C.E.

This navigation naturally divided itself into three districts.—The first divison, extending from the source of the river to the town of Newry, was shallow, circuitous, and obstructed; and, from the great inclination of the bed of the river, the current was very rapid: which combined causes prevented any other than small boats from navigating this part of the river. The second division, from Newry to Warren Point, was carried through the narrow channel of the river, for a length of 1¾ mile, then through an extensive tidal lake, for a length of 3 miles, as far as Narrow Water Castle, and thence to Warren Point, a further distance of 1¼ mile, where it entered Lough Carlingford. The navigation through this division was originally so defective, that only vessels of about 100 tons burthen could reach Newry at spring tides. The channel was extremely irregular, crooked, full of eddies, and difficult of navigation;—in some places it was dry at low water, and in many had not more than 2 feet 6 inches depth of water over shoals, with occasional rapid falls. The third division extended from Warren Point to the Irish Channel, through Lough Carlingford, a distance of 12 miles. In this division there was little difficulty, as the depth of water varied from 2 fathoms at Warren Point, to 20 fathoms at the entrance from the Irish Channel.

Such was the state of the Newry navigation in the year 1760. At that time the Irish Government directed the Board of Inland Navigation to examine the Port of Newry, and point out what was considered the best plan for improving it. After much investigation, it was finally decided to make a canal from Newry to a place called Fathom, on the south side of the river, and about 2 miles below the town. This canal was 80 feet in width at the top, and 9 feet 6 inches in depth. The entrance lock, at Fathom, was 128 feet in length, and 24 feet in width. This canal was opened for traffic in 1769, and effected a great improvement in the navigation, and consequently in the trade; as vessels of 120 tons were readily brought up to the town. Simultaneously with the completion of the canal, a floating dock, or basin, was made through the centre of the town of Newry, and from the upper end of it another canal, of smaller dimensions, for barges, was carried 9 miles up the valley, to the summit between the Newry and Bann rivers.

Again, in the year 1829, on the abolition of the Irish Board of Inland Navigation, a Company was formed, and an Act of Parliament passed, for transferring the whole of the works into their hands, and binding them to complete the navigation, according to a particular plan, within seven years from the passing of the Act.

According to this plan the river was straightened and deepened, in the first instance by giving full effect to the flux and reflux of the tide, and increasing the quantity of backwater, or natural scour, upon the bed of the river, and afterwards by means of dredging, blasting, and diving-bell work. The portion of the navigation from Doyle's Hole upwards was so liable to be silted up, and there was already so much alluvial matter requiring to be removed, that it was thought advisable to extend the canal from Fathom to this point. The size of the entrance lock was also increased, and the original canal itself much improved and deepened; so that vessels of about 500 tons burthen could reach Newry and discharge their cargoes directly into the warehouses.

The works for the improvement of the river, and the construction of the old canal, were commenced in 1830, and the extension and enlargement of the canal in 1842. The paper minutely described the details of the various locks, gates, rubble walls, embankments with pitching, and other constructions, the whole of which had been completed by April, 1850, at a cost of £170,000, of which £100,000 was the estimate for the new works, and about £60,000 for the old works.

In conclusion, the author directed the attention of members to the question, as to how far the advantages of dredging, and other artificial means, might be carried in the improvement of rivers, and where the canal became superior, both as to economy and certainty of result.

April 1st, 1851.

The first paper read was,—*A description of a raft or float used for submarine blasting on the works of the Hartlepool West Harbour and Docks.* By Mr. T. Casebourne, M. Inst. C.E.

This machine was contrived in consequence of the clay or marl, forming the bed of the channel into the harbour, being so hard at a certain depth, that the ordinary dredging machine was found to have little or no effect, owing to its want of stability. The new machine consisted of a platform or raft, supported by four legs, on each of which was fastened a rack, working into a pinion on the deck, so that the platform could be raised or lowered at pleasure. The working level on the ebb tide was about 8 feet above the level of the ground,—in which position it remained for about five hours, or five hours and a half, until the tide flowed again. During this time two sets of boring-irons were in use, working through wooden boxes or tubes, which made holes in the clay 4 inches in diameter, and of the required depth, for receiving a cartridge containing three to four pounds of powder, to which one of Bickford's fuzes was attached; the hole was then carefully tamped; and when the tide rose to the level of theplatform or raft, the fuzes were lighted, and the raft was floated away to some distance. The cost of this apparatus, complete, was stated to have been about £100.

The next paper read was,—*A description of the Lockwood Viaduct, on the Huddersfield and Sheffield Railway.* By Mr. John Hawkshaw, M. Inst. C. E.

This viaduct was described as consisting of 32 semicircular arches, each 30 feet span, one oblique arch of 40 feet span, and another oblique arch of 70 feet span,—the latter having a versed sine of only 7 feet. The piers were 4 feet 6 inches thick at the springing, and had a batter of one-sixth of an inch to the foot. The total length was 1428 feet, and the height from the foundations to the top of the parapet was 136 feet.

With the exception of the stone ribs of the flat oblique arch, and the string course and the coping—which were of ashlar—the whole structure, piers, arches, and parapet, was built of "snecked rubble masonry," composed of stones of all sizes, both as to length, thickness, and width of bed, laid in a thick bed of stiff mortar; but the beds and joints were roughly scabbled, so as to remove any projections, which might cause the stones to rock, or to act like a wedge on the course beneath; and the beds were laid as nearly horizontal, and the joints as nearly vertical, as the nature of the stone would permit. The largest stones were so placed as to form a perfect bond for those of smaller dimensions; a sufficient quantity of "throughs" being also used, and the whole work so built, that the workmanship of the inside and

outside of the walls was of uniform quality, both as to labour and material. This description of masonry was only about one-half the price of ashlar, and though not, of course, capable of bearing the same incumbent weight as could be supported by solid ashlar, it was considered superior, when carefully executed, to a thin facing of ashlar, with a hearting of rubble,—a mode of construction very frequently adopted.

The total cost of this viaduct, including the excavation for the foundations, the scaffolding, the centering, and every other expense connected with its erection, was £33,000, being at the rate of eighteen shillings and seven pence per cubic yard of masonry.

The Hall Bottom Viaduct, on the West Riding Union Railway, was another instance of a similar kind of construction,—the only difference being, that the piers had a greater taper; and to reduce the increased quantity of masonry which this plan involved, flues or hollow spaces were left in the piers, the sides of which followed the line of the face of the pier,—so that a uniform thickness of masonry was preserved throughout.

Two other viaducts, likewise designed by the author, but built of a different description of masonry, were also alluded to. The first, the Peniston Viaduct, on the Huddersfield and Sheffield Railway, was constructed of what was termed "block-in-course" work, which was a kind of rough-faced ashlar, the stones averaging about 12 inches in thickness, and from 15 inches to 18 inches on the bed, backed with a hearting of rubble masonry. The average cost of this kind of masonry, which required great care in the execution, was about twenty-one shillings per cubic yard.

The other viaduct was over the river Medlock, near Manchester, and differed from either of the others, inasmuch as the piers were composed entirely of ashlar, laid header and stretcher alternately, without any rubble filling or hearting. The spaces between the external walls were left vacant; but, as each header extended completely across the breadth of the pier, and the courses of masonry were alternated, the spaces were not continuous, as in the Hall Bottom Viaduct. The cubic contents of masonry in this work was proportionably much less than in either of the others, but the cost was far greater, being at the rate of two pounds five shillings and sixpence per cubic yard.

April 8th, 1851.

The first paper read was,—*A description of two bridges over the river Don and the canal, with the lodge and approaches, on the estate of Sir Joseph Copley, Bart., at Spotbro', near Doncaster.* By Mr. H. Carr, Assoc. Inst. C.E.

The object of these works was to form an always accessible means of communication between the village of Spotbro', situated on the north bank of the river Don, and the south side,—the only

means hitherto existing having been by an ancient ferry, which, from being situated immediately above a weir, was extremely dangerous in times of flood, and often perfectly unavailable. The works comprised a bridge of seven arches over the river Don, and another bridge of one arch over a short navigable cut, or canal (which had been made for the improvement of the river navigation), with the necessary embanked roads and approaches, and a lodge and gates at the junction with the old road on the Spotbro' side. The total length of these works was nearly one-third of a mile.

The river bridge consisted of a centre arch of 100 feet span, and three land arches on each side of 20 feet span each. The centre arch was composed of four laminated timber ribs, the outside planks of which were scarfed, and the interior ones set with a small space between the butt ends, so as to allow of the whole being keyed up by driving in hard oak wedges, when the arch was laid, and spikes were used instead of trenails. On removing the lagging of the centres, on which the ribs were framed, it was found that the weight was taken by the sides of the wedges, but even this was thought not to be so objectionable as the imperfection in the butt joint in the ordinary construction.

The interior of the land arches was constructed of brickwork, set in cement;—the rest of the work being composed principally of pitch-faced ashlar and rubble.

The bridge over the canal was 54 feet span, and 10 feet 9 inches rise. It was constructed in a similar manner, and of like materials, to the land arches of the river bridge, and had Sir Joseph Copley's arms carved in stone on two spandrils, and his initials reversed and entwined on the other two.

The works were executed by Messrs. T. and J. Waring, of Swinton, and occupied about fourteen months in construction, at a cost of about £7650.

The next paper read was,—*On the nominal horse-power of steam-engines.* By Commander L. G. Heath, R.N.

The inadequacy of the present term "nominal horse-power" for giving a definite idea either of the absolute or relative power of engines was first examined, by comparing the engines of H. M. S. Garland and Basilisk, which were both constructed on the same principle, with oscillating cylinders, and were both used to drive paddle-wheels. This comparison was made under three distinct heads,—the mean effective pressure, the number of revolutions per minute, and the size of the cylinders. It was urged that Watt's constant of 7lbs. per square inch, for the mean effective pressure, was not only in itself inapplicable, but that no constant quantity could be universally applicable. Also, that the method of determining the number of revolutions per minute, from a conventional speed, founded on the length of stroke of the piston, was equally fallacious.

It was therefore proposed, that the term "nominal horse power" should be abolished, and that engines should, in future, be designated by the cubic contents of their steam cylinders, jointly with their nominal consumption of a standard description of fuel during a given period of one hour. A table might be drawn up, giving this nominal consumption in terms of the grate and the heating surface, and should be accompanied by rules and directions for ensuring the uniform measurement of the grate and the heating surface. This system, it was contended, would be more in accordance with the present practice of construction, and would enable the relative size and power of engines to be more accurately estimated than by the present method.

April 15*th*, 1851.

The discussion was resumed on Commander HEATH's paper,—*On the nominal horse power of steam-engines.*

It was admitted that it would be very desirable to fix the nomenclature of the power of engines; for though it was well known that James Watt did really take as his standard what he found to be actually performed by a powerful horse, drawing a weight over a pulley,—viz., the equivalent of 33,000 lbs. raised one foot high in a minute,—yet, commercially, it had gradually become a custom among manufacturers to give a surplus of power, ostensibly as an allowance for the friction and deficiencies of the machine; so that now the mere statement of the nominal horse-power had no definite meaning.

It was, however, contended that the standard of 33,000 lbs. should be retained; and that, supposing the workmanship to be equally good in two engines, it was only necessary to compare the areas of the cylinders, the effective pressure of steam on the piston, and the speed of the piston, to determine their relative power. This was, in fact, shewn by the indicator, an instrument, the value of which was now universally admitted; and which, when skilfully used, did really give a true representation of the power of the engine.

It was the universal custom of Boulton and Watt to calculate the power exerted by an engine by the speed of the piston, together with the average pressure of the steam, as shewn by the indicator; and although much vagueness and uncertainty had latterly been introduced into the subject, this was rather to be attributed to the assumption of arbitrary quantities to represent those results, than to any defect in Watt's standard horse power, which definitely expressed both the measure of power and the space through which it acted.

The proposed standard of comparison of the quantity of water evaporated in a given time, by a given amount of fuel, or the combustion of a given quantity of fuel in a given time, was shewn

to be of no value; as then not only the generation of the steam, but the administration of it must be considered; and these were points merely tending to complicate the question.

For pumping engines, in Cornwall, the term horse-power was almost unknown; engines being sold to raise a given quantity of water,—which was a standard easily reducible to that of other districts where 33,000 lbs. was assumed to be the actual power of a horse.

The commercial question of what a manufacturer should give as a horse-power could not be discussed; for the actual power was only a small element in the actual cost of an engine,—that varying with every peculiar application of the machine. The surplus power now given by manufacturers had evidently arisen from a more perfect machine being now produced by the use of tools in the manufacture, the introduction of metallic rings instead of hemp packing, more perfect valves, and numerous modifications,—all of which were apart from, and independent of, the question of the original standard, which it was admitted could not be improved, and should not therefore be altered.

April 22nd, 1851.

The paper read was,—*On foundations, natural, and artificial.* By Mr. S. Clegg, Jun., M. Inst. C.E.

In defining the terms *natural* and *artificial*, as applied to foundations, the author said that natural foundations consisted of unstratified rock, stratified rock under certain circumstances, gravel, dry sand, pure clay, and other compact earths which had not been broken up. The most remarkable instance of a structure reared on an isolated stratified rock was that of the Eddystone Lighthouse, in which the friction of the joints, or beds, was capable of supporting it; but in a more northerly position, where frost might gradually destroy the cohesion, an isolated rock, stratified at an angle with the horizon, should be built upon with caution. Diving-bell work had been extensively practised for making foundations on rocks in deep water. Where less deep, the sand, shingle, and mud had been dredged away, leaving the surface of the rock untouched, and a foundation of large flat bedded stones laid on this up to low water of spring tides, at which point the surface was levelled and the ashlar masonry was commenced. If more careful building than this were required,—as, for instance, for the pier of a bridge,—the bed might be laid dry by a cofferdam, constructed like the one used for excavating rock on the river Ribble. If, however, stone, labour, and space, were alike abundant, the work might be founded with "pierre perdue," like the Plymouth and Cherbourg Breakwaters, the Aberdeen Pier, and the Portland Jetty.

Indurated slaty clay, or shale, might be looked upon as rock, if the foundation were laid so far beneath the surface as to exclude completely all atmospheric action: under which circumstances

pure clay was capable of bearing 5 tons per square foot. Foundations on gravel or dry sand, if the stratum equalled in depth the mean breadth of the foundation, might be considered, in practice, as incompressible; and water, percolating through the gravel, would not cause disturbance, although to sand it would be positively injurious.

The means of rendering weak soils capable of bearing the required load, or of making an artificial foundation, were these:—by using concrete and beton,—by employing caissons,—by piling with timber,—with platforms of timber, or fascines,—by filling trenches with sand,—by the use of the screw pile,—and the pneumatic cylinder.

The use of concrete dated from a very early period; for, according to Quartremère de Quincy, it was found in many Egyptian edifices, both in the foundations and in the construction of the walls; and Vitruvius, who wrote eighteen hundred years since, gave a description of a mode of preparing it then practised by the Romans. It had also been discovered in many Grecian temples, and in many Anglo-Saxon and Norman ruins in this country. It was, however, disregarded in England for about four centuries previous to the year 1800,—although it had always been used in France, either as a simple concrete, or beton,—when Mr. Ralph Walker employed it in the construction of the East India Docks. Concrete had been successfully used on the Southampton and Dorchester Railway for founding on a bog or morass; and although in England its application was now limited to works on land, it might be used with perfect safety under water, which only washed away the free lime from the surface; but with frost it gradually peeled away and was destroyed. One of the properties of concrete was its power of expansion, which rendered it peculiarly serviceable for under-pinning; for which purpose it had been used at one of the large storehouses in Chatham Dockyard.

The method of founding by means of caissons was introduced by Labelye, in 1740, who used them for the foundations of the piers of Westminster Bridge. In France, they were first used by De Cessart, in 1764, for the piers of the bridge of Saumur.

Timber-piling, and also platforms of timber, or fascines, were liable to decay when alternately exposed to the action of moisture and the atmosphere; but provided they were kept constantly wet, this decay did not take place. In driving an assemblage of piles, it was sometimes considered better to drive the sheeting piles before the bearing piles,—whilst, in other cases, exactly the reverse process was adopted: in the one case the sheeting piles were liable to be bent outwards; and in the latter the earth between the piles was not regularly compressed. It would be better that every other bearing pile should be driven first, and the outer row completed; and that then the sheeting piles should be driven, and afterwards the remainder of the bearing piles.

All these appliances, it was thought, would be replaced in a few

years, either by Mitchell's screw piles, or Potts' pneumatic cylinders, both of which had already been used with success on many large works. The former originated with the screw mooring, and had been successfully employed for the Fleetwood, the Belfast, the Maplin, and the Chapman Sand lighthouses, and in several other places—for a pier at Courtown, county Wexford—for the staging for the breakwater at Portland—for the foundation of many railway bridges and viaducts—and for many other important works.

The latter was first applied to a bridge on the Chester and Holyhead Railway, in which the tubes were sunk by means of a double air pump,—the pile sinking as the exhausting process was continued. Nineteen tubes, each twelve inches in diameter, were thus put down, so that their heads were level, and to them a cast-iron plate was fixed, on which the pier was built. Experience had shewn that it was advisable to make the tubes of greater diameter; so that now they were used 5 feet, and even 7 feet in diameter. In this case the simple exhausting process was not sufficient, by itself, to overcome the friction of the sides; another vessel had, therefore, been introduced between the tube and the air pump, and this was first exhausted, and then a communication was opened between the tube and the exhausted vessel, when a double effect was produced,—the excavating or exhausting process, as in the former instance, with the addition of a sudden blow on the head of the piles. A modification of this process had been adopted at Rochester Bridge, where the cylinders were used as diving bells, a plenum being established in them, so as to exclude the water,—allowing the excavation to proceed within by manual labor. This was found to be preferable; as the cylinders would not descend in a stony bottom.

The notice of the weights borne in practice by various natural and artificial foundations was reserved for a subsequent paper.

SOCIETY OF ARTS.

March 5th, 1851.

W. TOOKE, Esq., F.R.S., Vice-President,—in the Chair.

On the manufacture of smalt. By Mr. C. Tomlinson, Member.

This branch of manufacture is altogether foreign; and the chief material for it is almost entirely obtained from two small districts, one in Saxony, on the borders of Bohemia (visited by the author in the Autumn of 1847), and the other in Norway.

The use of the ore from which smalt is manufactured (termed by the miners of Schneeberg *cobalt*) was discovered by one Christopher Schurer, a glass-maker at Neudeck. He first col-

lected some of this Schneeberg ore, and tried it in his glass-furnace, when he found, to his delight, that it communicated to glass a beautiful blue color. This was about the year 1540, or perhaps earlier. Schurer made many trials of the new material, and at length succeeded in making of this blue glass *an enamel color*, well adapted to the use of the potter. This color found its way to Nuremburg, and at length to Holland, where it was highly appreciated by the Dutch artists. They sought out the humble glass-maker of Neudeck, and invited him, by large promises, to reveal his secret. He took up his residence for a time in Magdeburg, and had the ores of Schneeberg conveyed thither for the purposes of his manufacture. But he afterwards returned to Neudeck, and constructed a hand-mill for grinding his glass to powder, and afterwards another, which was driven by water. Meanwhile the Dutch had become expert in the preparation of the color, so that they obtained from 100*s.* to 120*s.* per cwt. for it, while the price in Saxony was only 22*s.* 6*d.* per cwt. At a later period, therefore, the Elector of Saxony had to invite the color-makers of Holland to teach their methods to his people; after which color-mills rapidly increased in the neighbourhood of the cobalt mines.

Thus, for a very long period, this beautiful color continued to be manufactured from a mineral whose composition was unknown. It was not till the year 1733 that the Swedish chemist, Brandt, obtained from this ore the metal which he called *cobalt*, and proved that the coloring matter is the protoxide. In 1780 Bergman confirmed and extended Brandt's results; and in 1800 the subject was taken up by the School of Mines at Paris, and investigations were also carried on by Thénard and Proust.

Metallic cobalt is a brittle metal, of a reddish-grey color; it fuses with difficulty; and has a magnetic character. This metal has not been applied to any useful purpose in the arts, and the interest attaching to it is purely scientific. The native combinations of cobalt are the oxide, and compounds of the metal with iron, nickel, arsenic, and sulphur.

To obtain the oxide in a state of tolerable purity requires much careful and laborious manipulation, varying somewhat, according to the nature of the ore. The first process is *picking*, by which stony fragments are removed, and the ores are separated into different qualities;—the richest being set aside for roasting, with little or no previous preparation, and those containing nickel being reserved for special treatment. The larger bulk of the picked ore is, however, subjected to the next process, which is *stamping* in a stamp-mill. Here a cam, or tappet-wheel, lifts up a number of pestles of pine-wood, shod with lumps of cast-iron, and, suddenly releasing them, allows them to fall by their own weight upon the ore, which is distributed in chests beneath. The stamp-troughs are furnished with a stream of water, which washes out the pounded ore, and carries it down an inclined plane, where the sand and earthy matters, being much lighter than the metal-

lic oxides, are carried farthest by the action of the stream, and are easily separated from the heavy and valuable particles. The ore, thus washed, is next *roasted* in a reverberatory furnace, provided with chambers for receiving and condensing the arsenic. The condensing-tube is upwards of 100 feet in length, or a shorter tube is connected with chambers of several stories, where the arsenic (an important article in commerce) is collected by men wearing a dress fitting tightly in every part, a helmet with goggles for the eyes, and a wet bandage or sponge tied over the mouth and nostrils. They are still further fortified for their dangerous occupation by drinking a glass or two of olive-oil. Their food also is regulated, and consists chiefly of vegetables, with abundance of butter. This is the system adopted in Silesia, at Reichenstein, and Altenberg, where large quantities of arsenious acid, realgar, and orpiment, are manufactured from arsenical pyrites.

In the roasting of cobalt, the ore is wetted and spread over the sole of the reverberatory furnace, in a layer five or six inches deep; it is then cautiously heated for six hours, during which time abundant fumes are produced, consisting chiefly of vapour of water and arsenious and sulphurous acids; and the heat is then increased, and continued for sixteen, eighteen, or twenty-one hours,—the ore being disturbed with a rake, to bring all parts under the action of the flame and of the air. When the ore becomes red hot, the operation ends; the ore is then withdrawn, and the furnace allowed to cool before a fresh charge is put in. The sand which was separated in the dressing is sometimes mingled, in certain proportions, with the ore in the roasting; and the product thus obtained is the zaffre or saffre of commerce: a crude product. *Smalt*, on the contrary, is a valuable and carefully-prepared vitreous compound—a rich blue glass, in fact—to be afterwards reduced to powder, and elaborated in the manner now to be described. Glass is well known to be a compound of a silica and an alkali; but this compound is not very stable. If we reduce a piece of glass to powder by grinding in a mortar, a considerable quantity of alkali can be washed out; and even by moistening pounded glass with water, a piece of turmeric paper will detect the presence of free alkali. Silica and potash, both very carefully prepared, calcined, sifted, and preserved from moisture, are mixed with oxide of cobalt, to form smalt,—the proportions varying according to the commercial variety of the article required.

The ingredients are intimately mixed in a wooden trough, two feet deep; and then they are transferred to the melting pots, which are built up in a furnace heated to the proper temperature,—each pot being first charged with an inferior blue glass in powder, called *eschel*, the effect of which is to give an interior vitreous lining to the pots. The smalt mixture is poured into the pots by means of iron ladles with long handles; and in about eight hours it fuses, and a vitreous crust is formed on the surface;—this is broken through and the mixture stirred by means of an

iron tool, made red hot for the purpose. When the pots appear at a white heat, their contents are quite fluid, and the chemical combination of the materials has been effected.

When the glass attaches itself to the workman's rod, and can be drawn out into threads, it is ready for pouring; but it must first be carefully freed from two impurities, which interfere with the very dark homogeneous blue color which the glass ought now to present. These are, first, *glass gall* or *sandiver*, which forms as a scum on the surface, and can therefore be skimmed off; and, secondly, the metallic impurities of the oxide, which sink to the bottom, but are sometimes met with in diffused globules throughout the lower portion of the glass pot. This sediment is of variable composition; but may contain cobalt, nickel, iron, arsenic, bismuth, and even silver: it is known in commerce by the name of *speiss*.

The pure blue glass is next taken from the glass pot in iron ladles; and as the object of subsequent processes is to reduce the glass to powder, that object is facilitated by emptying the ladles into vessels of water,—the water being constantly renewed. The glass being at a red heat when it first comes in contact with the water, is thus rendered, like Prince Rupert's drops, excessively brittle, granular, and easy to pulverize. When the glass pot is half empty, the workman examines the contents of his ladle, to see if any speiss is there; if so, he manages to separate it from the blue glass by skilful pouring. All the glass pots are thus emptied before a fresh charge is given to any one of them; for so great is the reduction of temperature in charging three or four pots, that the contents of the others would become solidified or too pasty to be ladled. The charging of the six pots reduces the furnace to a brownish-red heat; and an hour and a half is required to get it up again to the proper temperature, which is that of an ordinary glass furnace.

The next process in the manufacture of smalts is the apparently simple one of reducing the blue glass to powder. But, if we try the experiment of grinding to powder a portion of blue glass, we shall find that the substance, which by transmitted light had appeared so beautiful, is reduced in its disintegrated state to a light dingy powder; yet who can doubt that the same amount of coloring matter is present in the powder as in the glass? There are, therefore, difficulties to be overcome in converting a sheet of blue cobalt glass into a powder of an intensely blue color, and in obtaining all those shades and varieties of blue which are found in our manufactures. The processes are as follow:—The blue glass is first crushed in the dry state at a stamping-mill; then sifted to the size of ordinary sand; and this sand is afterwards ground in a mill between horizontal granite stones, in quantities varying from 1½ to 2 cwt. at a time. It is wetted with a little water, and the grinding is continued from four to six hours. The powder thus produced is then transferred to large vats full of water, and in the course of a very few minutes

a separation of particles takes place in the powder;—the heaviest, being those which are richest in cobalt, sink to the bottom; and this deposit constitutes one of the commercial varieties of smalts, known as *azure*, *coarse blue*, or *streublau*.

The water which holds the finer particles of the powdered blue glass in suspension is drawn off into other vats, where it is allowed to subside for three-quarters of an hour or more, according to the variety of smalt intended to be produced: this second deposit is called *farbe*, the German word for *color*. The water drawn off from this second deposit is poured into vats, and allowed to remain for an indefinite time; and its deposit is called *eschel*, or *blue sand*. But the colors thus obtained are all again subjected to the action of water before they are fit for the market. Each deposit is agitated in tubs abundantly supplied with water, and is again allowed to subside; while any floating impurities are removed with a sieve. The water then drawn off is treated as in the former case; and the various kinds of subsidence form different varieties of color.

The glass of cobalt appears to be a mixture of the less fusible silicates, in which *cobalt* prevails, and which resist, most perfectly, the action of the water; and of the more fusible silicates, in which *potash* prevails, and which are more susceptible of the action of water. The former silicates constitute the *azure*, or coarse blue; and the latter are partially decomposed by water, which subtracts a subsilicate of potash, and leaves a supersilicate of potash in a minutely divided state. *Farbe* owes its tints to the subtraction of potash; and *eschel* contains more silica, and less potash and cobalt than the other varieties.

The beauty of smalt is said to be heightened by what may be called accidental causes: the presence of four or five per cent. of arsenic and arsenious acids; from six to nine per cent. of phosphoric acid; and minute particles of zinc, tin, antimony, and nitre. On the other hand, it is deteriorated by the presence of nickel, lead, iron beyond ten per cent., bismuth, borax, soda, the alkaline earths, alumina, felspar, fluorspar, and sulphur.

The precipitates of smalt dry into hard masses, which are crushed by mallets, then passed between cylinders, and sifted in fine sieves: the sieves are enclosed within a wooden case, and are set in motion by machinery. The azure is next dried in a hot room, under the tiled floor of which passes a winding flue. A number of shallow wooden troughs are arranged in this hot room, and the smalt is placed therein, and is stirred up, from time to time, with a rake. When sufficiently dry, it is taken to another room, where it is subjected to a final sifting, and the manufacture is complete. It is then slightly moistened, to prevent waste, and packed in small casks containing half a hundred weight each, and marked with the name of the shade.

The applications of smalt to the arts were noticed and illustrated by numerous specimens of glass, porcelain, encaustic tiles, paper-hangings, &c., in which this color is employed.

March 12*th*, 1851.

JOHN SCOTT RUSSELL, Esq.,—in the Chair.

On the geometrical principles of beauty, more particularly as applied to architecture and the human form. By D. R. Hay, F.R.S.E., Member.

The following remarks—which are the substance of the explanation given of Mr. Hay's hypothesis by the Rev. Professor Kelland, of the University of Edinburgh, at the meeting of the British Association in 1850—will serve as an appropriate introduction to the present paper.

"The basis of harmony in music is the fact, that the ear is most pleased with that mixture of sounds in which the numbers of the vibrations causing the individual sounds, are expressed by some very simple relations. Thus, C and G form a pleasing combination, because the string which produces the one note makes two vibrations whilst the other makes three. But the combination of G and G sharp, the vibrations forming which are as 20 to 21, is exceedingly harsh. Mr. Hay's first position is, that the eye, in its estimation of spaces, is influenced by a simplicity of proportion analogous to that which guides the ear. This analogy between sight and hearing may be questioned; and it may be said that the eye judges of effects by passing from point to point, whilst the ear receives many sounds at once. But, in answer to this, it is clear that the standard of comparison is always present to the eye (which is equivalent to the key-note of a harmony ringing in the ear), and also that all our faculties are from birth under the influence of education; which is constantly tending to make their powers analogous, and to give them greater quickness and certainty in the estimation of intervals. The ear, perhaps, receives less involuntary education than the other faculties; but that it is susceptible of high cultivation every musician is aware; and great accuracy, both of eye and ear, must, generally speaking, be the result of cultivation.

"The process of education being similar in the two cases, it appears reasonable to conclude, that the simplicity of proportion which we saw was necessary to gratify the ear should be equally so for the satisfaction of the eye.

"Following the same analogy, Mr. Hay next infers, that as the ear estimates not by magnitude but by number of vibrations, so does the eye by *direction* and not by *distance*. And this appears to point to the reason of the very vague and unsatisfactory conclusions that have been arrived at by all writers, from Albert Dürer downwards, who have applied numerical ratios to the proportions of architecture or of the human form,—*length*, and not *direction*, or, in other words *linear* instead of *angular* proportion, having been considered."

The basis of the author's theory, then, is this :—A figure pleases the eye so far as its fundamental angles bear to each other the same proportion that the vibrations of the different notes in the common chord of music bear to each other.

This theory he endeavours to substantiate in the following manner:—In order to shew the nature of the harmony of sound, as related to or as evolving numerical harmonic ratio, he confines himself to the most simple mode of illustration, namely, that of the monochord, an instrument consisting of a single string, of a given length, stretched between two points. Supposing this string to be stretched until its tension is such that, when drawn a little aside and suddenly let go, it would vibrate at the rate of sixty-four vibrations in a second of time, producing to a certain distance in the surrounding atmosphere a series of pulsations of the same frequency, these pulsations will communicate through the ear the musical note literally signified by C; and that would be the fundamental note of the string in its present state of tension. Mr. Hay then refers to the fact, that, immediately after the string is thus put into vibratory motion, it spontaneously divides itself by a node into two equal parts, each of which vibrates with double frequency, producing 128 pulsations in a second of time, and consequently producing a note doubly acute in pitch, and which is the most consonant to the first sound, relating to it as 2 to 1. It next spontaneously divides itself into three parts by the formation of two nodes; the vibrations of each of those parts relating to the first series in their frequency as 3 to 1; and thus it continues in arithmetical progression to a considerable extent, agreeably to the quality of the string. These notes are called, in the art of music, the harmonics, and may be excited artificially by touching a vibrating string upon the point at which any node would naturally occur. Amongst these harmonics arise the fundamental parts of the science of music in this way.

All notes produced by the division of the string into 2, 4, 8, &c. parts, are octaves to, or repetitions of, the fundamental note.

All these produced by the division into 3, 6, 12, &c. parts, are dominants or fifths to it.

And all those produced by the division into 5, 10, 20, &c., are mediants or thirds to it.

To any one, Mr. Hay observes, having the slightest knowledge of music, these notes, in all their various degrees of pitch, are the elements of all harmony and agreement of sounds of which the human ear is susceptible.

Mr. Hay next proceeds to shew how he applies this principle of numerical harmonic ratio to forms. He takes the right angle, formed by the meeting of a vertical with a horizontal line, as the fundamental angle, corresponding to the note C; and from this he describes a quadrant of the circle; and from the point where this quadrant meets the horizontal line, he draws another vertical line of indefinite length. Dividing this quadrant by 2, 3, 4, 5, &c., he draws lines from the right angle through those divisions, meeting the indefinite vertical line at greater degrees of altitude, and at more acute angles, as the parts of the quadrant between

its half and its vertical side become smaller. These lines form, with the horizontal and the indefinite vertical line, a series of right-angled triangles, which Mr. Hay employed in the production of geometric beauty in forms, as effectively as the harmonies are employed in the production of harmonic beauty in sounds. He shews, by diagrams, that the most perfect geometrie figures—the square, the equilateral triangle, and the pentagon—which constitute the elements of the five regular solids or platonic bodies, arise from the division of the quadrant, exactly in the same way that the octave to the fundamental note, the dominant, and the mediant, arise from the spontaneous divisions of the monochord.

He next explains his terminology, and shews how every figure, whether rectilinear or curvilinear, has an elementary angle of some portion of a right angle, which, being applied as its name, at once explains its proportions: thus, the scalene triangle of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, &c.; the rectangle of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, &c,; the isosceles triangle of $\frac{1}{2}$, $\frac{1}{3}$, &c.; the ellipse of $\frac{1}{3}$, $\frac{1}{4}$, &c.; the composite ellipse of $\frac{1}{2}$, $\frac{1}{3}$, &c.. He next explains how these figures may be combined agreeably to the angles from which they are named, so as to produce beauty to the eye as effectually as the combination of various notes, whose frequency of vibrations agree in similar ratios.

In order to prove the applicability of this angular system in the rectilinear formation to an architectural elevation, the author proceeds to shew, that spaces in which the prominent lines are horizontal and vertical lines, are agreeable to the eye when all the principal parallelograms fulfil the condition, that the diagonals make with the sides angles which are exact sub-multiples of a right angle, agreeably to the harmonic divisions by 2, 3, and 5, and sometimes 7. This he exemplifies by taking a given horizontal line as a base; from one end of which he draws diagonal lines, forming with it $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, of the right angle, meeting a vertical line at the other end of the base; and the rectangles formed upon these diagonals he next divides by angles of $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, and $\frac{1}{9}$ of the right angle: by which simple means he produces the rectilinear skeleton of an octostyle Doric portico, of the same proportions as those of the portico of the Parthenon or Temple of Minerva at Athens;—shewing, at the same time, that the composition of this unequalled structure is partly horizontal, partly vertical, and partly oblique, and that its angular elements corresponded exactly to the elements of that beautiful harmony called the chord of the flat seventh.

In imparting, through his system, true æsthetic proportion to the representation of human figures, such as the ancient Grecians imparted to the statues of their deities, the author first applies it to the permanent structure of the bones; because it is in the relative positions, sizes, and forms of the various parts of this internal structure that we find those approximations which nature makes in every direction to the perfect development of that funda-

mental law of beauty, which we have hitherto felt to exist, although its nature has been involved in mystery. He therefore states his opinion to be, that without a knowledge of the osseous structure, it is impossible for the artist truly to represent the external form of the human figure.

To construct a diagram, by which such a skeleton may be formed as will impart to a representation of the human figure such proportions as characterise the ancient Grecian statues of Venus, Mr. Hay adopts the following harmonic angles, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$, $\frac{1}{8}$, $\frac{1}{9}$, $\frac{1}{10}$, $\frac{1}{12}$, and $\frac{1}{14}$, of the right angle, which he takes as the fundamental angle of this figure only as being the most truly beautiful.

Mr. Hay gives no measurements whatever of length or breadth —he simply adopts a vertical line to represent the full height of the figure, whatever that may be, whether intended to be engraved in miniature upon a precious gem, or sculptured of the most colossal dimensions. The proportions of every part of the skeleton, whether as to relative length, width, or depth, and the form of the cranium and face, as well as of the thorax, whether viewed in front or in profile,—he determines by the adoption of those eleven angles alone; and the process by which he does so is a very simple one.

After having drawn the given line of supposed height, he draws from its apex five lines, forming, with the vertical line, angles of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{7}$, and from its base five lines, forming angles of $\frac{1}{8}$, $\frac{1}{9}$, $\frac{1}{10}$, $\frac{1}{12}$, and $\frac{1}{14}$, of the fundamental or right angle. Through the point where the line of $\frac{1}{4}$ intersects the line of $\frac{1}{8}$, he draws another vertical line, cutting all the lines which were drawn at the above angles from each end of the original line of height. Through the point where this last vertical line cuts the line of $\frac{1}{3}$, he draws a line forming an angle of $\frac{1}{2}$, with the original line of height. Through this point, and through all the other points of intersection which the indefinite vertical line makes with the other lines, he draws horizontal lines cutting the original line of height. This, with a repetition of the angles $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{7}$, forms the principal part of the diagram, and gives all the required proportions.

Although the remainder of the process is simple, yet it cannot be demonstrated without diagrams, as there are ellipses and circles to describe, the proportions of which are determined by the triangles already constructed.

When a form, characterized by that massive strength and masculine power which the ancient Greeks gave to the proportions of their representations of Hercules, is to be constructed, all the change Mr. Hay requires to make upon his diagram is the adoption of an angle of $\frac{2}{5}$ the semicircle, instead of a right angle, as his fundamental angle; and this he considers the greatest extreme in this direction; and states, that all the numerous varieties of proportion which are exhibited in the statues of ancient Grecian deities, will arise from the adoption of one or other of the nume-

rous intermediate angles that lie between 90° and 108° as a fundamental angle.

Mr. David Roberts, R.A., and Mr. Weigall, mentioned two facts with regard to the human figure, which it was desirable should be confirmed by Mr. Hay's theory. These were,—first, that the extreme length across the outstretched arms equals the whole height of the figure; and, secondly, that the profile of the head can almost invariably be circumscribed by a perfect square.

March 19*th*, 1851.

JOHN SCOTT RUSSELL, Esq.,—in the Chair.

A letter from Mr. Hay, in answer to the questions raised at the conclusion of the last meeting was read, as follows:—

In reply to the question, "Does my theory give any countenance to the ordinary observation, that the length across the outstretched arms equals the height of the figure?" I beg to say that it does so, and in a more ample way than it is introduced by Vitruvius, or adopted by Flaxman; for neither of these, nor any other author that I know of who has made the statement, seem to have been aware that this equality depends upon one of the most variable proportions of the human form, namely, the width across the shoulders.

The Venus, whose governing angle is 90°, will be found to be within about a 120th part of her full height of touching the sides of the square with the ends of her longest fingers; while those of the Hercules, whose governing angle is 108°, would be about a 56th part of his full height beyond the sides of the square; because, although the width across the shoulders differs, the relative length of the arms is the same in each.

It must therefore be a figure whose proportions are governed by an angle lying between 90° and 108°, whose outstretched arms could exactly equal his height. The angle of 101° 15′, I think, would give such a figure; for his general proportions would be something between those of a Venus and a Hercules; in short, the proportions of an Apollo.

In reply to Mr. Weigall's query, I beg to say that the head is another part of the figure, the proportions of which are variable in the sexes. The head of my Venus can be exactly inscribed within a square; but the male head is somewhat less in depth from front to back, than in height from under the chin to the crown of the head. This, however, is quite natural; for anatomists have found that the skulls of females are always deeper from back to front than those of males.

That my angular system of proportion is applicable to the muscles as well as to the bones, I have fully shewn in the plates to my forthcoming work.

A communication was read from Dr. Wampen to the following effect:—

The varieties of the forms of the human figure fall under three classes, which may be called the Broad, the Proportionate, the Slender forms;—answering to the Hercules, Antinöus, and Mercury of the ancients.

These classes are determined as follows:—Take the entire height of the figure and divide it into 64 parts or units, and call each unit h; divide the half circumference round the chest into 19 units, each $= b$; then we shall find that all forms will divide themselves into the three classes mentioned above:—

In the broad form h will be less than b.
„ proportionate h will be equal to b.
„ slender h will be greater than b.

The following proportions are fully established by measurement:—In the "proportionate" form the height of the pelvis and the length of the lower part of the thorax are each equal to $8h$; while in the "broad" form they equal $8h + \frac{8b - 8h}{2}$. Here the trunk increases in length, while the legs decrease; and the proportion between the thigh and the thoracic circumference also decreases. Similarly, in the "slender" form, the lower part of the *thorax* equals in length $8h + \frac{8h - 8b}{4}$; and so with the height of the *axilla*, &c.

There is harmony between all the parts in each kind of form; but each integral is only suitable to its own kind of form. Therefore beauty consists, not only in the harmony of the elements, but in their being suitable to the kind of form.

In respect to the question of the arms, the author had always found the length of the extended arms, in the "proportionate" or normal form, greater than the entire height, occasionally by as much as five inches: in one of Flaxman's designs for Antinöus it is so.

Mr. Weigall exhibited a diagram of a male skeleton which he had drawn from the best specimen at the College of Surgeons. The original was 5 feet 6 inches high; and in the diagram, the height of Mr. Hay's figure having been assumed, all the parts were proportionately increased. It differed from Mr. Hay's mainly in the legs being longer, in the clavical being shorter, and, consequently, the width across the shoulders less, and in the arms being longer. The skeleton from which it was drawn was of the broad class. Mr. Weigall had been much surprised to find that the height of the actual skeletons at the College of Surgeons was 9, and, in some cases, 10 heads, instead of 8, as we are taught.

On the other hand, it was argued by Mr. Waterhouse Hawkins and others, that Mr. Hay's purpose was to lead us to the *beau ideal*, which it was a contradiction in terms to seek for in actual

specimens—that measurements from skeletons, which have undergone articulation, are not to be depended on, the removal of the cartilaginous processes altering every proportion. Added to which, very few skeletons are made up of the bones of one subject; and those met with in hospitals and museums are often those of diseased persons, or chance comers, not selected with a view to symmetry.

Mr. Wyndham Harding regretted that, after all that had been written on the subject from Aristotle downwards, we are still without rules to tell us what beautiful proportion is. As an attempt to escape from this uncertainty, Mr. Hay's enquiries were worthy of every encouragement.

Scientific Adjudication.

NORTHERN CIRCUIT.—LIVERPOOL,

7th April, 1851,

Before Mr. Baron Platt and a Special Jury.

NEWTON *v.* VAUCHER.

The Attorney-General, Mr. Knowles, Q. C., Mr. Adolphus, and Mr. Crompton, were counsel for the plaintiff; and Mr. Watson, Q. C., Mr. Cowling, and Mr. Atherton, for the defendant.

This was an action for the infringement, by the defendant, James Ulric Vaucher, of a patent granted on the 15th May, 1843, to the plaintiff, for and on behalf of Mr. Isaac Babbett, of Boston, in the United States, for "certain improvements in the construction of boxes for the axles or axletrees of locomotive engines and carriages, and for the bearings and journals of machinery in general." There was a second claim in the patent, for oiling and lubricating of carriage journals; but this part of it was not at all in question. Before Mr. Babbett's invention, the bearings of journals of locomotive engines and railway carriages were invariably made of brass or gun-metal,—the castings being bored and fitted for the reception of the journal. The great evils consequent upon the use of gun-metal bearings, were the great abrasion and consequent heating of the journals, and the large expenditure of oil for lubricating purposes. It was very frequently found that the axle became red hot,—so great was the abrasion; and the necessity for using water to cool the journals was of daily occurrence. The effects of the heat were of course disastrous, and often resulted in the fracture of the axle. The hardness of the gun-metal prevented the bearing from accommodating itself to the running axle—the pressure was uneven—they did not wear together, but unequally; and the bearing was constantly requiring to be changed or replaced; and when once worn, it was, of necessity, absolutely useless.

To remedy these difficulties Mr. Babbett, of Boston, after much labor and many experiments, invented a new kind of bearing, for which he took out, through Mr. Newton, the nominal plaintiff in this action, a patent for England, Scotland, Ireland, and several of the continental states. This bearing consists of a shell of brass or gun-metal, with a lining of a soft metal, composed chiefly of tin. The gun-metal shell is provided with rims or fillets for confining the soft metal, and preventing it spreading under pressure. The inside of the shell is first thinly coated with tin; the shell is then placed on an even surface over a mandril, the exact size of the journal, and the space or interstice betwixt the turned surface of the shell and the steel mandril is filled in with white metal, through a hole bored in the top of the gun-metal shell. The step or bearing is then complete and fit for use, requiring no boring or fitting. The advantages of this bearing are very great, and were not called in question during the trial. The combination of the hard shell and soft lining is just what was required to obviate all the difficulties attendant upon the use of brass or gun-metal. The hard shell was ample to support all the superincumbent weight; and the soft metal lining was just what was needed to receive the friction of the journal. From its unctuous properties it prevented all abrasion, and consequently all heat—it required very little lubricating material—was several times more durable than gun-metal—and, when worn out, the shell was quite as ready for the reception of a fresh lining of soft metal as though it were new. Several steps or bearings were exhibited in Court, one of which, taken from the "Hercules," an engine on the Great Western Railway, had run between seventy and eighty thousand miles, and shewed no signs of wear on its surface.

The invention attracted the notice of parties interested in its use, and was speedily adopted by many railway companies. It appeared that, in the year 1845, an action was brought by the present plaintiff against the Grand Junction Railway Company, for an infringement of this patent; and, after a trial, which lasted two days, a verdict was given for the plaintiff, with damages £1000. This case was subsequently argued before the Judges, and the patent right was fully established at that time. Since that period, Mr. Babbett's invention had become still more extensively adopted, and was now in use on most of the railways in Great Britain and the continent, and also in Her Majesty's yacht, and the Admiralty steamers, &c. In the year 1848, the defendant addressed to Mr. Woods, the then acting agent of Mr. Babbett, a communication, intimating that Babbett's patent was an infringement of a patent taken out by him (Vaucher) in the year 1838. This was the first time Mr. Babbett or his agents had heard of any such previous patent, and it was considered remarkable, that if any such previous right existed, it was not enforced at the time of the trial in 1845,—whereas, it had been

suffered to sleep for five years. Enquiries were at once made, and it was then discovered that the patent taken out by the defendant in 1838, was for "certain improvements in fire-engines, watering-engines, and other hydraulic machines," and did not in any way relate to the lining of bearings. Vaucher's patent was for the application of soft metal for the *packing* of pumps and such machines, to exclude air or water, and render chambers air or fluid tight.

Nothing further was heard of the defendant until the year 1850, and in June of that year the defendant enrolled a specification of a patent for "improvements in the manufacture of axletree-boxes for carriages, and of the bearings of the axles of railways, and in making an alloy of metal suitable for such and like purposes." This the learned counsel contended was a bareface imitation of the plaintiff's patent. The defendant having supplied the Great Western Railway Company with some of his bearings, a bill was filed in July, 1850, to restrain the defendant from manufacturing such bearings, and a motion for an injunction was made *ex-parte* to the Master of the Rolls, on the 31st of the same month. The injunction was granted, with leave for the defendant to move to dissolve it. The defendant brought on his motion on 2nd September; and, instead of standing on his new patent, the defendant set up his pump patent of 1838,—contending, as he had done to Mr. Wood's in 1848, that the plaintiff's patent was an infringement of that one; and he further contended that his second patent was an improvement of the first, though the first was not, in any manner, referred to in it. The Master of the Rolls continued the injunction. This action was then commenced in the Court of Exchequer. The defendant pleaded, 1st. Not guilty; 2nd. That the plaintiff was not the true and first inventor; 3rd. That the invention was not new; 4th. That the letters patent were not for a manufacture, as provided for in the statute.

The Attorney-General entered into a full description of the defendant's patent, explaining the same by the aid of models. The defendant's pump, which was produced in Court, was packed with soft metal, in accordance with his specification, for the purpose of rendering its compartments and piston fluid and air-tight; and it was pointed out to the jury, as a remarkable fact, that, in the two bearings of the piston-axle in his own pump the defendant did not use soft metal, but brass; thus shewing that he had no idea of using soft metal for any other purpose than for packing. It was asked by the Attorney-General, why, if the defendant had a right, under his first patent of 1838, to the manufacture of axletree bearings, he should trouble himself to take out another patent in 1850? It was admitted on all hands, that the lined bearings were never used until after plaintiff's patent of 1843; and that the defendant, in his specification of 1838, never once used the word *bearing*, but only *packing*.

Witnesses were called on the part of the plaintiff, to prove the complete dissimilarity of the two patents. Amonst whom were Messrs. Robert Stephenson, M.P., Joseph Glynn, late Chairman of the Eastern Counties Railway Company, James Nasmyth, of Patricroft, John Kirk, of Bolton, Benjamin Fothergill, of Manchester, and Professor Woodcroft, of King's College.

Mr. Watson, for the defendant, spoke at length in reply, contending that the packing of the plaintiff was in fact identical with the *lining* of the defendant; and called, as witnesses, Messrs. Roberts, of Manchester, Gibson, of London, and Carpmael, of London, Walter Macgregor, of Liverpool, &c.

The Attorney-General having replied—

The learned Judge briefly summed up, and left the issues to the jury.

The first is disposed of, if you think the tin shell, sold to the Great Western Railway, was an infringement of the patent.

Second, as to the inventor. In law, any one who first introduces is the inventor.

Third, as to the denial that it is new. No witness proves that this was ever used before Newton's patent; and, as the Attorney-General says, why did defendant take out his second patent? If it was not included in the first, he can't give himself the monopoly by taking out a new patent.

Fourth. It is for you to say whether the making of these boxes is a manufacture;—I think there is no manner of doubt it falls within the definition. Of the evidence you must judge. There is one important fact:—Part of the consideration for the monopoly is, that a party shall specify so that every party shall have the use after the expiration of the patent. He is bound to state the evil he proposes to remove. The learned Judge then read the defendant's specification, and proceeded:—The defendant has nowhere pointed out as having for his object the diminution of friction. It is only to make pumps and such machines water-tight and air-tight. If he had such intention, it is extraordinary he did not state it. The plaintiff's patent is for the application of known subjects to a new purpose, useful to the public. If you think plaintiff's specification is contained in defendant's, you will find for defendant; but, if not, for plaintiff. You are not to take the former trial into consideration. You will say whether the invention is new; and whether it is a manufacture.

The jury at once found for the plaintiff, with nominal damages 40*s*.

The Judge certified it was a fit cause to be tried in the superior court, and for a special jury; and also that the validity of the patent was called in question under 5 and 6 Geo. IV., c. 4.

The trial terminated on Tuesday, 8th April. Attorneys for the plaintiff, Messrs. Tatham, Upton, Johnson, Upton, and Johnson, Austin Friars; for the defendant, Messrs. Hull and Terrell, Basinghall Street.

List of Patents

That have passed the Great Seal of IRELAND, from the 17th March to the 17th April, 1851, inclusive.

To William Hodgson Gratrix, of Salford, in the county of Lancaster, engineer, for certain improvements in the method of producing or manufacturing velvets or other piled fabrics.—Sealed 20th March.

William Stones, of Queenhithe, in the City of London, stationer, for improvements in the manufacture of safety-paper for bankers' cheques, bills of exchange, and other like purposes.—Sealed 25th March.

John Ransom St. John, of the City and State of New York, in the United States of America, engineer, for improvements in the process of, and apparatus for, manufacturing soap,—being a foreign communication; and also improvements made by himself.—Sealed 28th March.

Frederick Watson, of Moss-lane, Hulme, Manchester, in the county of Lancaster, Gent., for improvements in sails, rigging, and ships' fittings, and machinery and apparatus employed therein.—Sealed 28th March.

Herbert Taylor, of No. 46, Cross-street, Finsbury, in the county of Middlesex, merchant, for certain improvements in the manufacture of carbonates and oxides of barytes and strontia, sulphur or sulphuric acid, from the sulphates of barytes and strontia, and for consequent improvements in the manufacture of carbonates and oxides of soda and potassa,—being a foreign communication.—Sealed 2nd April.

George Shepherd, of Holborn-bars, in the City of London, civil engineer, and Charles Button, of the same place, operative chemist, for certain improvements in the means or appliances used in conveying telegraphic intelligence between different places.—Sealed 16th April.

List of Patents

Granted for SCOTLAND, subsequent to 22nd March, 1851.

To David Davies, of Wigmore-street, Cavendish-square, London, coach-maker, for certain improvements in the construction of wheel-carriages, and in appendages thereto.—Sealed 24th Mar.

Charles Xavier Thomas, Chevalier de la Legion d'Honneur, of Paris, for an improved calculating machine, which he calls arithmometer.—Sealed 25th March.

William Milner, of Liverpool, patent tube and safety-box manufacturer, for certain improvements in safes, boxes, and other depositories, for the protection of papers or other materials from fire.—Sealed 26th March.

John Stephens, of the Albynes, in the parish of Astley Abbotts,

in the county of Salop, for certain improvements in thrashing-machinery.—Sealed 28th March.

James Cheetham, the younger, of Chadderton, near Oldham, manufacturer, for certain improvements in the manufacture of bleached, colored, or party-colored threads or yarns.—Sealed 2nd April.

James Black, of Edinburgh, machine-maker, for a machine for folding;—part of which invention has been communicated to him from abroad.—Sealed 3rd April.

William Boggett, of St. Martin's-lane, London, and William Smith, of Margaret-street, London, engineer, for improvements in producing and applying heat; in lighting; and in engines to be worked by steam or other elastic fluid; which engines are also applicable to pumps.—Sealed 3rd April.

Henry Duncan Preston Cunningham, of Bury, paymaster and purser, R. N., for improvements in reefing sails.—Sealed 4th April.

James Hamilton Browne, of the Reform Club, Pall Mall, London, for improvements in the separation and disinfection of fecal matters; in the purification of gas; in the preservation of animal matters; and in the apparatus employed therein,—being a communication.—Sealed 9th April.

Thomas Greaves Barlow, of No. 32, Bucklersbury, London, civil engineer, and Samuel Gore, of Park-road, Old Kent-road, London, engineer, for improvements in the treatment of certain substances, used in the production of gas for giving light and heat, and of some of the products of the said substances; as also in the apparatus employed in the manufacture of such gas, and in discharging and giving motion to gas.—Sealed 9th April.

William Galloway and John Galloway, of Manchester, engineers, for improvements in steam-engines and boilers.—Sealed 14th April.

Samuel Holt, of Stockport, manager, for certain improvements in the manufacture of textile fabrics.—Sealed 14th April.

John James Greenough, now residing in Washington, United States of America, for an invention of improvements in obtaining and applying motive power,—being a communication.—Sealed 14th April.

David Christie, of No. 3, St. John's-place, Broughton, Salford, for improvements in machinery or apparatus for preparing, carding, spinning, doubling, twisting, weaving, and knitting cotton, wool, and other fibrous substances; also for sewing and packing,—being a communication.—Sealed 14th April.

Benjamin Guy Babington, of George-street, Hanover-square, London, M.D., for improvements in preventing incrustation of steam and other boilers.—Sealed 16th April.

Henry Bessimer, of Baxter House, Old St. Pancras-road, London, engineer, for improvements in the manufacture and refining of sugar, and in machinery or apparatus used in producing a

vacuum in such manufactures; and which last improvements are also otherwise applicable for exhausting and forcing fluids. —Sealed 17th April.

Thomas Hill, residing in Langside Cottage, near Glasgow, for certain improvements in wrought-iron or malleable iron railway chairs, and in the machinery or apparatus employed for producing the same,—being a communication.—Sealed 17th April.

New Patents
SEALED IN ENGLAND.
1851.

To John Gwynne, of Lansdowne-lodge, Notting-hill, in the county of Middlesex, merchant, for improvements in machinery for pumping, forcing, and exhausting of steam, fluids, and gases; and in the adaptation thereof to producing motion to the saturation, separation, and decomposition of substances,—being a communication. Sealed 31st March—6 months for inrolment.

John Peter Booth, of Cork, in the Kingdom of Ireland, feather purifier, for an improved manufacture of fabric applicable to the construction of muffs, boas, tippets, and other like articles; and also to the ornamenting of articles of dress and furniture, and other similar uses. Sealed 31st March—6 months for inrolment.

Louis Brunier, of Paris, civil engineer, for improvements in obtaining power by the use of steam or compressed air. Sealed 31st March—6 months for inrolment.

Joseph Richardson, of Halifax, in the county of York, dyer, for improvements in dyeing and cleansing piece-goods. Sealed 31st March—6 months for inrolment.

Auguste Motte, of Southwark, in the county of Surrey, manufacturer, for certain improvements in portmanteaus. Sealed 2nd April—6 months for inrolment.

Thomas Huckvale, of Choice Hill, in the county of Oxford, for improvements in treating mangol-wurzel, and in making drinks and other preparations therefrom. Sealed 2nd April—6 months for inrolment.

Richard Archibald Brooman, of Fleet-street, in the City of London, patent agent, for improvements in machinery for the manufacture of rope and cordage,—being a communication. Sealed 2nd April—6 months for inrolment.

William Barker, of Hulme, near Manchester, millwright, for improvements in machinery for chipping, rasping, and shaving dyewood and other materials, and in apparatus connected therewith. Sealed 7th April—6 months for inrolment.

Christopher Cross, of Farnworth, near Bolton, in the county of Lancaster, cotton-spinner and manufacturer, for certain improvements in the manufacture of textile fabrics, and in the

manufacture of wearing apparel from textile materials. Sealed 8th April—6 months for inrolment.

John George Appold, of Finsbury-square, Gent., for improvements in machinery for regulating and ascertaining the labor performed by manual or other power. Sealed 9th April—6 months for inrolment.

Charles Mc Dowall, of Hyde-street, Bloomsbury, in the county of Middlesex, watch-maker, for certain improvements in the construction of time-keepers. Sealed 9th April—6 months for inrolment.

Henry John Betjemann, of Upper Ashby-street, Northampton-square, in the county of Middlesex, for improvements in connecting parts of bedsteads and other frames, and in machinery employed therein. Sealed 15th April—6 months for inrolment.

Frederick William East, of the Firm of Thomas East and Son, Bermondsey, leather-dressers, for improvements in dressing, embossing, and ornamenting leather. Sealed 15th April—6 months for inrolment.

Benson Stones, of Warwick-street, Golden-square, in the county of Middlesex, for improvements in the use and treatment of peat and its products, and other carbonaceous matters; and also for apparatus applicable to such and other chemical purposes. Sealed 15th April—6 months for inrolment.

Herman Schroder, of Bristol, Gent., for improvements in manufacturing and refining sugar. Sealed 15th April—6 months for inrolment.

Antoine Victor Coutant, of Paris, in the Republic of France, iron master, for an improved mode of partially hardening iron for various purposes. Sealed 15th April—6 months for inrolment.

Thomas Greaves Barlow, of 32, Bucklersbury, in the City of London, civil and consulting gas engineer, and Samuel Gore, of Park-road, Old Kent-road, engineer, for improvements in the treatment of certain substances used in the production of gas for giving light and heat, and of some of the products of the said substances; as also in the apparatus employed in the manufacture of such gas, and in discharging and giving motion to gas. Sealed 15th April—6 months for inrolment.

Charles Hardy, of Low Moor, in the county of York, engineer, for certain improvements in the manufacture of scythes,—being a communication. Sealed 15th April—6 months for inrolment.

Robert Newell, of the City of New York, in the United States of America, lock manufacturer, and a citizen of the said States of America, for certain new and useful improvements in the construction of locks. Sealed 15th Apr.—6 months for inrolment.

Thomas Keely, of the town of Nottingham, manufacturer, and William Wilkinson, of the same place, frame-work knitter, for improvements in machinery for manufacturing textile and woven fabrics, and other articles composed of fibrous or filamentous materials; also for improvements in the said fabrics and articles. Sealed 17th April—6 months for inrolment.

Frederick Puckridge, of Kingsland-place, in the county of Middlesex, merchant, for improvements in the preparation or manufacture of materials or fabrics suitable for ornamenting furniture and other articles. Sealed 17th April—6 months for inrolment.

William Andrews, of George-street, Westminster, in the county of Middlesex, mechanic, for certain improvements in steam-engines and in boilers, in pumps, in safety-valves, and in wheels and axles. Sealed 24th April—6 months for inrolment.

William Smith, of Snow-hill, in the City of London, gas-meter maker, and Thomas Phillips, of Brighton, in the county of Sussex, gas-fitter, for certain improvements in apparatus for heating, ventilating, and cooking by gas. Sealed 24th April —6 months for inrolment.

Robert Hawkins Nicholls, of Pimlico, in the county of Middlesex, Gent., for improvements in machinery for giving motion to agricultural and other machinery. Sealed 24th April—6 months for inrolment.

Joseph Clinton Robertson, of Fleet-street, in the City of London, for improvements in musical instruments,—being a communication. Sealed 24th April—6 months for inrolment.

Disclaimers and Amendments
OF PARTS OF INVENTIONS

Made under Lord Brougham's Act,—subsequent to February 1st, 1851.

Disclaimer and memorandum of alteration, filed with the Clerk of the Patents for England on the 25th March, 1851, by Joshua Radcliffe, of Oldham, cotton manufacturer, and John Tomlinson Hibbert, of London, Gent. (executors of Elijah Hibbert, deceased), and John Platt and James Platt, both of Oldham, engineers, assignees of a patent granted to Edmund Hartley, of Oldham, in the county of Lancaster, bearing date the 11th day of December, 1848, for an invention for "certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton and other fibrous substances;" whereby they disclaim and alter certain parts of the specification to such letters patent.

Disclaimer and memorandum of alteration, filed with the Clerk of the Patents for England on the 26th March, 1851, by Thomas Spencer, to the specification of a patent granted to him for "certain improvements in machinery or apparatus for manufacturing pipes or tubes from clay or other plastic materials; part or parts of which improvements are applicable to the manufacture of hollow earthenware;" bearing date the 10th day of April, 1848.

CELESTIAL PHENOMENA FOR MAY, 1851.

D.	H.	M.	
1			Clock after the ☉ 2m. 59s.
—			☽ rises 5h. 10m. M.
—			☽ pass mer. 0h. 9m. A.
—			☽ sets 7h. 42m. A.
	9	2	Ecliptic conj. or ● new moon
2	9	5	☿ in conj. with the ☽ diff. of dec. 7. 4. N.
4			Occul. χ² Orionis, im. 10h. 24m. em. 10h. 36m.
	9	52	♃'s second sat. will em.
5			Clock after the ☉ 3m. 26m.
—			☽ rises 7h. 27m. M.
—			☽ pass mer. 3h. 28m. A.
—			☽ sets 11h. 52m. A.
	0	32	♀ in Aphelion
	2	28	♃'s first sat. will em.
	21	48	♀ in conj. with ♂ diff. of dec. 0. 36. N.
6	8	52	♃'s first sat. will em.
7			Occul. δ Cancri, im. 6h. 54m. em. 8h. 5m.
	10	33	Ceres in conj. with the ☉
8	1	34	☽ in ◐ or first quarter
9	14	32	☿ stationary
10			Clock after the ☉ 3m. 47s.
—			☽ rises 1h. 20m. A.
—			☽ pass mer. 8h. 17m. A.
—			☽ sets 2h. 33m. M.
	13	0	☽ in Perigee
11	22	[illegible]	♃ in conj. with the ☽ diff. of dec. [illegible] 37. S.
12			Occul. 80 Virginis, im. 14h. 5m. em. 14h. 50m.
	0	[illegible]	♃'s second sat. will em.
13	10	[illegible]	♃'s first sat. will em.
15			Clock after the ☉ 3m. 54s.
			☽ rises 7h. 44m.
			☽ pass mer. Morn.
			☽ sets 4h. [illegible]
	[illegible]	[illegible]	Ecliptic oppo. or ○ full moon
16	[illegible]	[illegible]	☽ in descending node
	18	[illegible]	☽ in conj. with Pallas
17			Mercury R. A. [illegible] dec. [illegible]
			Venus R. A. 1h. [illegible] dec. 6. [illegible]
			Mars R. A. [illegible] dec. [illegible]
			[illegible] R. A. [illegible] dec. [illegible]
			[illegible] R. A. [illegible] dec. [illegible]

D.	H.	M.	
17			Pallas, R. A., 1h. 19m. dec. 0. 36. N.
	—		Ceres R. A. 3h. 17m. dec. 13. 53. N.
	—		Jupiter R. A. 12h. 53m. dec. 4. 6. S.
	—		Saturn R. A. 1h. 47m. dec. 8. 40. N.
	—		Uranus R. A. 1h. 59m. dec. 11. 38. N.
	—		Mercury pass mer. 0h. 18m.
	—		Venus pass mer. 21h. 42m.
	—		Mars pass mer. 21h. 23m.
	—		Jupiter pass mer. 9h. 13m.
	—		Saturn pass mer. 22h. 6m.
	—		Uranus pass mer. 22h. 17m.
19			Vesta in Perihelion
20			Clock after the ☉ 3m. 47s.
	—		☽ rises Morn.
	—		☽ pass mer. 4h. 7m. M.
	—		☽ sets 8h. 20m. M.
	12	23	☿ in inf. conj. with the ☉
21			Occul. γ Capri, im. 12h. 41m. em. 13h. 26m.
22	23		☽ in Apogee
23	1	5	☽ in ☐ or last quarter
	19	19	♀ in conj. with ♄ diff. of dec. 0. 27. S.
25			Clock after the ☉ 3m. 26s.
	—		☽ rises 2h. 13m. M.
	—		☽ pass mer. 7h. 52m.
	—		☽ sets 1h. 41m. A.
26	3	25	♀ in conj. with ♅ diff. of dec. 1. 27. N.
	4	18	☿ in Aphelion
	18	52	♂ in conj. with the ☽ diff. of dec. 4. 21. N.
27	6	6	♄ in conj. with the ☽ diff. of dec. 3. 1. N.
	10	50	♅ in conj. with the ☽ diff. of dec. 4. 54. N.
	14	0	♀ in conj. with the ☽ diff. of dec. 3. 27. N.
	22	43	♀ greatest hel. lat. S.
28	9	46	☿ in conj. with Ceres, diff. of dec. 0. 42. N.
29	7	54	☿ in conj. with the ☽ diff. of dec. 1. 12. N.
	12	55	♂ in conj. with Pallas, diff. of dec. 3. 6. S.
30	5	47	Ecliptic conj. or ● new moon

J. LEWTHWAITE, Rotherhithe

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THE INDUSTRIAL EXHIBITION.

INTRODUCTION.

——————— Man is one;
And he hath one great heart.—Festus.

Many have been the partial responses to this important truth; but at no previous period of the world's history do we find the manifestation of an all-pervading power impelling mankind to the attainment of some yet unaccomplished end. Long since was the chivalry of Europe content, at the call of a wild enthusiasm, to stay for awhile its petty strifes and jealousies, and, martialling under one banner—the emblem of a common faith—to strike with one accord for what was then deemed a high and holy object; but it was reserved for the present generation to witness a far more ennobling proof of brotherhood—in the assembling of nations to commemorate the triumph of unobtrusive Industry, and pay a tribute to her worth in the Crystal Temple dedicated to her honor. It is impossible, we think, for any contemplative mind to view with indifference, or as a matter deserving only of passing comment, the successful carrying out of the great scheme for gathering under one roof the sample products of the world's industry. Whether we consider the congregated treasures as the result merely of the awakened, sustained, and concentrated *purpose* of the thousands who have taken part in this unexampled labor—a purpose which, from being honored by the great and noble, will not be quickly lulled to sleep—or anticipate the friendly interchange of sentiments and experiences which the occasion is likely to call forth, the conclusion would seem to be, that *progress*—the only true test of civilization—must henceforth become far more generally the aim and object of mankind: in other words, the current of ambition will be fairly turned from the acquirement of martial to the achievement of that more enduring fame which results

from the conquest of inanimate nature and its subjugation to the use of man.

It has been stated by a celebrated writer,* as an incontestible fact, that more havoc is made by men on men in one year than has been made by all the lions, tigers, leopards, bears, wolves, and elephants, upon their several species since the beginning of the world;—if, therefore, this passion in man for exterminating his species is somewhat lessened, by drawing his attention to more desirable fields for conquest, the festival of Industry will not have been held in vain. There are, however, other purposes which it is eminently calculated to accomplish, and will doubtless fulfil. It is impossible that any work shall be in esteem, and the doer of it be disregarded: labor being in honor, the calling of the laborer must of necessity be honored; and the drones of society will therefore fall into their proper place. Man is called upon to subdue the earth,—it is his duty; and it behoves every member of the human family to perform his part. How far this labor has advanced, is supposed to be made known by the Exhibition of the Industry of all Nations; and it is under this view that it may be said to possess a distinctive and important character, which marks it from all former accumulations of industry, and gives it a special claim upon our attention. That, on a close examination, we shall find some branches of the manufactures but imperfectly represented, we have no doubt; yet, as far as our experience goes, we think the Exhibition may be received as a reliable evidence of the present state of development of the physical sciences. But so overpowering is the sense of being surrounded by the represented industry of the world, that the faculty to realize any distinct impression in connection with the marvellous accumulation of products, seems paralyzed while the eye is gazing upon them. It is only when calmly reflecting upon the scenes through which we have wandered, that we perceive, in this great monument of human labor, an impersonation of the spirit of the age. The earnest desire of men to supply their physical wants is everywhere apparent. Whether these wants be imaginary or real—whether they refer to food, clothing, or shelter—to the spanning of the waters—to the annihilation of time and space—to the transmutation of darkness to light, of cold to heat, of deformity to beauty, or of silence to sweet sounds—all are wholly or in part anticipated, and this not in disregard of the higher aspirations of the mind. Poetic inspiration, it is true, is here received in but one form; but the genius of the sculptor has nobly embodied it.

* Edmund Burke.

In traversing the mazy walks of the Crystal Palace, the poet, the philosopher, and the utilitarian, may each gather pearls of wisdom. To them alike the goodness of an all-wise Providence will be manifest. Each will be led to understand that Nature is rife with treasures for the use of man, and that intelligence alone is requisite to assign to every natural product its separate office. The poet—glancing from the rude chaos of raw materials to the embroidered vestment, the speaking organ, or to some bronze group or statue, which, flowing shapeless from the reeking furnace, took the form of beauty to which it was ordained—may perceive that striving at perfection in man's creative power which marks out his celestial origin, and learn therefrom to sing a loftier hymn of praise. The philosopher may trace the steady growth of man's developed powers, and reasoning from analogy—comparing past with present times—may convince himself of the folly of those far-sighted dreamers, who had fathomed Nature's stores, and could foretel the period of their exhaustion. The utilitarian, too, if he has a thought beyond his money-bags, may here find food for meditation. He will see the skill of the workman turned to the production of the thousand elegancies of refinement; and perhaps, in acknowledging that the demands of taste afford at least profitable occupation to a large section of the community, he may be led to suspect that what he has hitherto considered beneath his notice, may possibly, through some perversity of his own mind, be above his comprehension. But not alone to these is the Exhibition calculated to provide instruction. It would not, perhaps, be overstating the case, to say, that the statesman, wearied with the perpetual din of party strife, might, in the contributions of the various nations, trace the benefits which flow from liberal governments, and thereby gain a mollient to his troubled spirit. If these may severally extract some benefit from a pilgrimage to the Temple of Industry, how much more those who raised it—the blood and sinews of the land—and the various classes who, through the minute division of labor, have unconsciously contributed to its enrichment. Here the miner, drawn from his abode of darkness, may, for the first time, perceive the thousand uses to which the treasures he has dug from the bowels of the earth are brought. The skilful artizan, admonished of the importance of his calling, may learn a valuable lesson on self-respect—the stepping-stone to success in life. To the profound scholar in applied sciences, new matter for his admiration, or the exercise of his speculative vein, will be presented. Tyros may hither flock, and learn to talk of wonders that will serve their

lifetime. Indeed, all may enjoy the intellectual treat—except, perhaps, the poor reviewer, who gazes with despair upon the countless thousand things which are to form the subject for his pen; or, yielding to their irresistible attraction, is led up endless vistas, down labyrinthine walks, up winding stairs, through darkened corridors, until his physical and mental powers together fail him. But his is not altogether a hopeless case;—the settled purpose of his mind eventually dissolves the spell by which he was beguiled, and gives him power to work the chaos of his thoughts into a consistent shape, and shew the world where, and for what reason, they must bestow their admiration. Without a commentary of this kind, much of the information which the Exhibition furnishes would be lost—not merely to those who lack the opportunity of paying it a visit, but also to such as diligently explore its treasures. We have stated some results that may be obtained; but these are incidental, and dependent wholly on the frame of mind of the spectator;—there are, however, others of a more positive character, which the Exhibition is calculated to yield, and for the attainment of which it was originally promoted. These are—not the breaking down of nationalities—nor the boastful and invidious proof of British supremacy—much less the humiliating confession of inferiority in the industrial arts (for all these aspersions have been thrown out by the opposers of the project)—but (1st.) the instruction of the manufacturer, whether master or workman, by his introduction to processes and plans used in other branches of industry, and applicable, under certain modifications, to his own; or by demonstrating to him the fallacy of some prejudice that has hitherto prevented him from employing some improved process or machine that was open to his use; or by calling his attention to products far superior to his own; and thus affording a wholesome stimulus to the attainment of further improvements. (2nd.) The public will gain an insight into many matters which have hitherto been shrouded in mystery, but of which it has been very necessary to know something; and they will thenceforth be less open to deception. (3rd.) But, perhaps, the greatest benefit which this peace offering is calculated to effect, will consist in the overwhelming incontrovertible proof it lays open to all the world, of the division of labor being equally beneficial to nations as to individuals; for the jealousy of one nation of the superiority of its neighbour in any branch of the physical arts, arises from a mistaken notion of its own powers and peculiar advantages. If the line of policy in industrial affairs is henceforth dictated, by the governments of those states which exhibit, according to the unmistakable indications of

nature and the genius of their people, the entangled knots of foreign diplomacy will be at once and for ever disposed of, and the free trader will be enabled to buy in the cheapest and sell in the dearest markets to his heart's content. We shall then hear no more the cry of "protection," for the desire for it will have ceased; much less shall we see the continuance of those costly and injudicious projects which obtain so much in Europe—the naturalizing of exotic branches of industry, by lavishing upon them grants of public money, in the vain hope of their taking root in an incongenial soil: it is only, as we believe, in the market gardener's province, that artificial stimulants can be systematically applied with profit. Perhaps there is no class of manufactures in which England more strongly asserts its supremacy than in that where iron is used as the raw material; but it would be folly to encourage a jealous restlessness at the unapproachable skill displayed by the Berlin artists in that material; so also would it be with that extraordinary people, whose genius leads them to extemporize railroads out of timber trees and hurdles, and aim at the subjugation of primeval wastes—if they were seriously to attempt a competition with Great Britain in textile manufactures. It should be remembered, that to concentrate in one country the means of supplying all the physical wants of man, is, if not an impossible task, to shut up that country, so provided, from all intercourse with the rest of the world. What effect this would have upon the people themselves may be read in the history of the Chinese nation. It is one thing to develope the resources of a country by the introduction of a new manufacture, and another to force, at the expense of a suffering people, the growth of a branch of industry which will require constant assistance from the executive to keep it in existence. Morality and virtue might thus be introduced, at any pecuniary sacrifice, if governments could find the heart to do it; and even the fine arts, which add so much to man's intellectual gratification, might, with propriety, be thus encouraged; but whether the industrial community be employed on ten, twenty, or a hundred branches of manufacture, it matters not, so long as their wants are thereby provided for: that is the great point, and we trust that to it the attention of foreign governments will be drawn through the instrumentality of the Great Exhibition.

Much has been said and written by thinking men upon the danger attendant on the great increase of national wealth; and its inordinate growth has been shewn, by reference to history, to portend a nation's fall: thus Rome, Venice, and Spain, have been cited as examples; and we are scarcely left to infer—for

it is but too plainly stated—that England is to follow. Among this school of prophets, the "Exhibition of the Industry of all Nations" is looked upon as the culminating point of British vanity, and the sure index to the declension of our national greatness. In the friendly invitation which has been the means of concentrating such trophies of the peaceful arts upon our shores, we cannot, for ourselves, perceive a feeling akin to that which prompted Judah's king to parade his treasures before the Babylonish princes; nor do we, therefore, participate the fear that, like Hezekiah's, the wealth of Britain, so fully indicated in the Crystal Palace, will, to our discomfiture, become the prize of our invited guests. The purpose of the Exhibition was, at least, a fair and honest one; and so far as we can judge, we think the desired end will be attained. Of the danger which may accompany the increase of our national resources we have little fear, so long as the growing wealth is honestly acquired, and pretty evenly distributed; but national poverty we know, from the experience of Ireland, is an unmitigated evil. If, therefore, the development of the physical sciences is allowed full scope—receiving, from time to time, such judicious encouragement only as the present Exhibition is calculated to bestow—we shall find that, though the stream of invention may flow on impetuously, and be the means of rapidly enriching the community, it may be made to subserve the general good; while all attempts to stay the current, or bring about a reflux of the stream, must end in turning it into other channels, and leaving us without resources. It would scarcely be in place to enter here into that vexed question of political economy—the labor market, and shew that the only means of meeting the growing wants of an increasing population, in a highly-cultivated country, like Great Britain, is by enlarging her industrial resources—not by employing human labor where mechanism will best answer, but by opening out new fields for industry through the skilful application of scientific knowledge. To what extent this has been carried, of late years, we shall have occasion to refer in treating of the several classes of industrial products contained in the Exhibition; and it is, we think, to this remarkable characteristic of invention that, not merely the wealth but even the political existence of this country is mainly due; for no invention, we may boldly state, which is calculated to economize manual labor in an extensive branch of manufacture, or one that is capable of great extension, can be brought into general use without eventually increasing, instead of lessening, the demand for labor in that branch of manufacture. This is, doubtless, a seeming paradox to those who have not well considered the

subject, yet it admits of easy proof, which will hereafter be incidentally given. But while we rejoice in the progress made, and the hopeful indications of future advances, in the application of the physical sciences to the wants of man, we should not be unmindful that his mind as well as his body requires attention. That this has not been overlooked by the organizers of the Industrial Exhibition, is evident from the efficient manner in which sculpture, the decorative arts, and music, are represented; and, indeed, no less could have been expected, where the Prince Consort is the life and soul of the executive body. Thus, to the growing idolatry of gold (which paralyzes all the finer qualities of the mind) an antidote is found, for those who will receive it, in the refining influence of the works of art,—which, by their presence in the Exhibition, also illustrate one of the noblest branches of industry: without these, the display would have been indeed imperfect. But, apart from these embodiments of imagination and fancy, there is yet an example of high-souled aims and patient application, which, both from the benefits which are certain to result therefrom, and the actual labor demanded in the execution of the work, must, on comparison, dwarf all the other creations of man which the Temple of Industry contains. We allude to the unobtrusive display made by the British and Foreign Bible Society. In their literary labors, by which the Scriptures have been made intelligible to every nation, people, and tongue, we recognize the link that binds mankind into one fellowship, causing them to feel—

> "With a gigantic throb athwart the sea,
> Each other's rights and wrongs, ——"

and aid in the restoration of that unanimity of purpose which has been wanting on the earth since its presumptuous use called down the Divine displeasure at the Tower of Babel; but which seems now again, for a better object, to be dawning on the world. Thus do we find at once the bodily, mental, and spiritual wants of man acknowledged and provided for; and, as a record of the manner in which some of these have been supplied, as well as for the purpose of rendering the means employed intelligible to the general reader (to whom, for the first time, we now address ourselves), we shall, agreeably to our promise of last month, proceed at once to illustrate the Exhibition in a series of essays, which will severally refer to one branch of practical science;—such form of writing having been chosen, as it offers facilities for marking the progress of the manufacturing arts, and affording occasional suggestions for their further improvement.

RAW MATERIALS.

AMONGST the raw productions of Great Britain, what may be termed its mineral wealth, occupies an important and conspicuous position; for, independently of the cost of carriage, or any manufacturing process, the present annual value of the mineral produce of this country is probably not less than twenty-five millions sterling. However much, therefore, the material prosperity of England may be connected with the industrial energy of its inhabitants, we must not overlook the fact, that wealth, to the above extent, is yearly contributed by our mines alone, and is, moreover, a kind of wealth specially adapted for industrial investment. It is, in this latter respect, that Great Britain differs so largely from many other countries; for, taking California as an example, it may be argued, that the mineral produce of this infant state is already rapidly approaching our own in value; and such, undoubtedly, is the case—indeed, the gold of California may perhaps ultimately, as a raw production, surpass the yearly amount of our mineral produce. But there is this remarkable difference between the results obtained,—that, whereas the value of gold resides in itself, and scarcely admits of the slightest increase by the hand of labour,—the coal, iron-stone, and other raw materials of this country, afford room for an unlimited investment of industry, by which their value may be increased to any required extent. Thus, although the iron-stone of England, in its raw state, is not worth, per ton, the quarter of an ounce of the raw gold dust of California, yet labour may be so concentrated upon it, as to develope an article worth more, weight for weight, than the most costly jewellery fabricated from gold. Of this, steel chronometer balance-springs afford an instance in point; selling, as they do, in some cases, at the rate of ten or twelve guineas an ounce. It is, therefore, in the peculiar nature of our mineral wealth, and not in its amount, that we have so great an advantage over other countries; and, for the same reason, Great Britain may almost be said to have a monopoly of certain arts and manufactures, which monopoly has, more or less, the invariable effect of all monopolies, in retarding improvement. On this account it is that we propose to examine, separately, every branch of manufacturing industry, and point out that which is wasteful or defective, leaving it to the inventive skill and energy of our readers to devise remedies for evils which they have not seen, merely because habit had reconciled the eye to their existence.

Having thus briefly announced the object and intention of our remarks, the reader will feel no way surprised at finding coal selected as the first article for consideration, since it constitutes, not only the most valuable mineral production of this country in a money point of view, but is also the very *fons et origo* of our industrial wealth. As a raw material, there is not, perhaps, in coal, much to furnish matter for the successful employment of an inventive mind; though, even here, Warlich, Wylam, and others, have found their reward. But in the application of this substance as fuel, there are many improvements needed, any one of which would amply remunerate the author of an actual amelioration. It is quite susceptible of positive proof that, by no arrangement yet discovered, can more than two-thirds of the heat generated by a given quantity of coal, during combustion, be fairly absorbed and utilised in any of our manufactories; and, moreover, there are undeniable facts, which demonstrate that seldom, in the burning of coal, are more than three-fourths of the total heat, which might be eliminated, actually obtained—thus justifying the supposition, that one-half of all the coal now consumed, is virtually wasted, and lost to society. The first of these defects, or the non-absorption of heat, by the various objects exposed to the action of fire, has pretty largely attracted the attention of inventors; and, within the last twenty years, several very satisfactory improvements have been produced, especially with reference to steam-boilers. For the most part, these improvements have consisted in lengthening the flues, and exposing a larger surface of the boiler to the action of the heated air passing from the furnace to the chimney. From this arrangement, a vast economy of fuel has resulted, and particularly from that form of setting, known under the term "Cornish boiler setting." But there is yet a point in this matter which requires careful investigation, and that is, the extent to which the current or draught, in such flues, ought to be retarded, so as to favor the transmission of heat from the flue to the interior of the boiler. Remembering that air is an extremely bad conductor of heat, and that water about to become converted into steam is also a bad conductor, it is evident that time must form an important element in the perfect transmission of heat from one of these to the other; and hence, with a great velocity of current existing in the flues, very little heat would pass from air, however high its temperature, to water contained in a boiler, and so circumstanced in respect to its all but gaseous condition. As an illustration of this line of argument, we may adduce the case of gunpowder,

which, although forming a most intense heat, by its combustion, scarcely warms the barrel of a gun, through which it rushes during an explosion. Here the barrel of the gun may be said to represent the flue,—the force of the explosion the draught, and the gaseous products of the gunpowder those of an ordinary fire during combustion; yet the rapidity with which the heated air passes is so great, that the whole calorific effect is lost, and, as it were, thrown into the chimney.

In corroboration of these views we may direct attention to the results of some experiments on fuel made at the Museum of Practical Geology by Sir H. de la Beche and Dr. L. Playfair, and which clearly shew, that, to open the damper of a steam-boiler furnace, is pretty generally to diminish the effective power of the fuel: there can, in fact, be no doubt that great waste of coal now arises from inattention to this simple circumstance; and that much of the heat of the fire, which ought to go to the boiler, is lost by its hasty transmission to the chimney. If, however, there be thus far room for improvement in the direction just indicated, still wider is the vacant space, caused by imperfect combustion, or, in technical phrase, "bad stoking." We cannot sufficiently insist upon the necessity for some speedy and judicious alterations in this matter; and, to be really useful, these alterations should either supersede the employment of a stoker altogether, or render negligence on his part capable of immediate and certain detection. If the combustible constituents of common coal be regarded as composed solely of hydrogen and carbon, and the heating power of hydrogen be as is represented—three times greater than that of carbon—no reasonable being can fail to perceive the enormous folly of permitting any portion of the hydrogenous constituent of coal to escape from the furnace unburnt; for its loss implies the waste of three times its weight of the solid or carbonaceous constituent. Nevertheless, so uniform and systematic has the waste of hydrogen become, from the prevalence of bad stoking, that several eminent engineers, unacquainted with the real facts of the case, have come to regard the calorific value of a coal as proportioned only to the carbon it contains; thus attributing no heating power whatever to the hydrogen; and this too in the face of the circumstance, that the common gas of our streets is largely used for cooking purposes, and yields, weight for weight, more than double the quantity of heat given out by either coke or charcoal! As usually employed, fully one half of the hydrogen of bituminous coal passes unconsumed up the chimney, merely because the stoker, to economise his labor,

and avoid trouble, throws on to the bars of his furnace a thick layer of fuel; by which loss is caused in two or three directions. In the first place, as no atmospheric air can force its way through the heap, a process of distillation takes place from the upper surface of the carbonaceous mass, exactly as happens in a gas-retort; and when the whole of the volatile matters have been thus driven off, and not before, the residuary cinder or coke enters into combustion. No wonder, then, that practical men have arrived at the conclusion, that this coke fairly represents the value of the coal; for, as we have seen, combustion begins only when nothing else is left. But the loss of the hydrogen is not the only waste consequent upon throwing too much coal at once upon the fire-bars. Dr. Kennedy long ago proved that the hottest part of a furnace is about one inch above the fire-bars,—for there perfect combustion goes on, and the carbon consumed is converted into carbonic acid, with the total evolution of all its heat. But, let us imagine a mass of red-hot coke or cinder, two or three inches thick, lying above the carbonic acid thus produced, and through which, consequently, it must pass, to communicate its heat to the boiler or chimney. In passing over this red-hot coke, the carbonic acid would be converted into carbonic oxide, and thus not only remove a quantity of carbon equal to its own, without yielding any additional heat, but actually with the production of cold, or, in other words, the absorption of heat; for the volume of carbonic oxide, engendered in this manner, is double of that of the carbonic acid originally formed; and hence this expansion must be accompanied by the disappearance of heat, which becomes latent in the carbonic oxide. Here then are three distinct sources of waste, consequent upon this single mal-practice, which however entails, as a necessary sequence, the production of loss from a different cause. As by heaping a large quantity of fuel upon the furnace-bars, a stoker is enabled to neglect, with impunity, his duty for many minutes—so it frequently happens that this neglect is continued until portions of the fire-bars, becoming uncovered by fuel, permit the ingress of cold air in a large quantity through these openings; and thus not only is the combustion of the remaining coal retarded by this mis-direction of the draught, but the aggregate temperature of the whole furnace is vastly diminished. Now, we can scarcely conceive a more tempting or a more promising field of inquiry than is opened out in the great question, How are these evils to be effectually got rid of? Thousands of individuals in this country have the means daily in their hands

of making practical experiments upon this subject; but they are not, perhaps, even aware that such evils exist. Let us then hope that some few of these persons may be roused into a state of useful activity, and that the advent of another Exhibition may be preceded by some invention, capable of counteracting this great national loss. It is, beyond all others, a problem within the domain of the humblest working man. Before quitting the article coal, we feel that a few observations on the present modes of estimating the value of that substance, in a commercial point of view, are called for.

In the investigations undertaken at the Museum of Economic Geology, three different methods have been adopted; the whole of which, judging by the results, seem defective and worthless. The experiments were meant to have special reference to the boilers of marine engines, yet those made have been upon a Cornish boiler, set after the Cornish fashion. Independently therefore of the fact, that the results thus obtained are, to the last degree, unsatisfactory and discrepant, they furnish no guide by which to judge of the effects that might follow when a marine boiler is used. Of the two other methods, the one consists in making an ultimate analysis of the coal by peroxide of copper; the other by the quantity of litharge capable of being reduced by a given weight of the coal. Both of these processes seem to have been conducted on by far too small a quantity of matter to yield a result worthy of confidence; for but 3½ grains of coal were taken, on an average, for ultimate analysis, and only 5 grains for the litharge assay. The errors of manipulation are, therefore, relatively excessive; and, as a consequent result, we find these methods contradicting each other to something like 15 or 16 per cent.,—as a careful examination of the parliamentary report will prove. For the sake of illustration we select, at random, four samples of coal thus treated, merely premising that the amount of lead deduced from the ultimate analysis was found, by estimating the atoms of lead, carbon, oxygen, and hydrogen, respectively, at the numbers 104, 6, 8, and 1. Thus calculated, we have the following discordant figures given by the two methods in question, which, it is needless to say, present differences greater than can possibly exist between any two kinds of coal whatever:—

		By Litharge.	By Analysis.	Difference.
Newcastle Coals	Bates' Hartley	144·6	162·8	18·2
	Hastings' Hartley	142·8	166·4	23·6
Welsh Coal	Lynvi	161·2	175·8	14·6
Lancashire Coal	Laffak	134·4	163·8	29·4

Thus Bates' Hartley, which, by the litharge assay, is better

than the Hastings' Hartley and Laffak, turns out, from the ultimate analysis, worse than either of them. We deem it useless to pursue this subject farther, enough having been shewn to prove the utter inadequacy of the means now employed for ascertaining the calorific value of coal. The most likely method of effecting this object would be, to burn a given weight of each coal, in a vessel filled with pure oxygen gas, and surrounded by a large body of cold water; ignition being commenced by a fine platinum wire, heated through the agency of a galvanic battery. Some experiments made in this way, for a special purpose, have given the most uniform and satisfactory results.

The only manufactured articles made from coal are coke and coal-gas. The burning of coke resolves itself into two objects; and, as neither of these are gained, or sought to be gained, by gas manufacturers, it becomes necessary to distinguish between what is called gas-coke and oven-coke. The word coke applies, properly, to the latter alone; for, in a manufacturing sense, the former is merely cinder. The production of good coke requires a combination of qualities in coal not very frequently met with; and hence first-rate coking coals can be procured only from certain districts. The essential requisites are, first, the presence of very little earthy or incombustible ash; and, secondly, the more or less infusibility of that ash. The presence of any of the salts of lime is above all objectionable,—after which may be classed silica and alumina; for the whole of these have a strong tendency to produce a vitrification, or slag, upon the bars of the furnace in which the coke is burnt; and in this way the bars are speedily corroded or burnt out; whilst the resulting clinker impedes or destroys the draught, by fusing over the interstices of the bars or air passages. Iron pyrites is a common—but, except in large quantity, not a very serious—obstacle to the coke maker; for it is found in practice, that a protracted application of heat in the oven dissipates the whole of the sulphur from the iron, with the production of bisulphuret of carbon and metallic carburet of iron,—the latter of which alone remains in the coke, and, unless silica be present, has no great disposition to vitrify after oxidation. One object, therefore, gained by the oven coke manufacturer over the gas maker, is the expulsion of the sulphuret of carbon, and consequent purification of the residuary coke. Another, and a still more important consequence of a long-sustained and high heat is, the condensation or contraction of the coke into a smaller volume, which, therefore, permits the introduction of

a much greater weight into the same space; an advantage of vast importance in blast furnaces, and, above all, in locomotive engines, as the repeated introduction of fresh charges of cold fuel is thus prevented. Part of this condensation is due to the weight of the superincumbent mass of coal thrown into the coke oven, by which (when the coal first begins to cake or fuse together) the particles are forced towards each other, and the cavernous character of cinder got rid of; but the chief contraction arises, as we have said, from the natural quality of carbon, which, like alumina, goes on contracting—the longer and higher the heat to which it is exposed. Hence, good coke cannot be made in a short time, and that used in locomotive engines is commonly from 48 to 96, or even 120 hours in the process of manufacture.

The prospects of improvement in coke making seem not very great, and point rather to alterations in the oven than in the process; nor does it seem possible to utilize the heat evolved by the gaseous constituents of the coal; for this heat, though large in quantity, is of trifling intensity, and, consequently, admits of but a restricted use in the arts; moreover, the incessant variations to which it is subject, according to the period of manufacture, still farther interfere with its employment, even where great intensity of fire is not needed, as in steam-boilers, for example. Nevertheless, there appears no valid reason why sets of coke ovens might not be so arranged as mutually to compensate for each other, and produce upon one particular flue a constant and uniform effect. Contrivances of this kind have been projected,—but hitherto, we may suppose, without success, as our largest coke makers still continue the old mode of working.

The process of gas-making from coal is in itself so large and singular an operation, and has, besides, such a variety of connections with other branches of industry, that, though its details and possible improvements might very correctly follow upon an analysis of the coke maker's art, yet we prefer to treat of it amongst the more advanced and scientific manufactures, rather than associate its comprehensive traits of civilized skill with the rough and ready exigencies of "Raw Materials," incidental to this early stage of our progress. We feel, too, that the introduction of such a subject here would, in some degree, break the geological connection which exists between coal and iron,—a connection, by the bye, equally remarkable in a mercantile aspect. Hence, quitting coal, we come at once upon iron, and find a wide field of enquiry in respect to the physical qualities of this metal.

The Great Exhibition is before us, and we solicit serious attention to the fineness of grain, and compactness of structure, which characterize various samples of iron contained in the Swedish, Spanish, and Austrian departments. These are specimens of charcoal-iron, and do not owe their evenness of texture to accident or chance, for it is the invariable attribute of charcoal-iron. Yet it is wanting in all iron made by coke or coal, which just as invariably possesses a rough hackley grain, and a crystalline structure. It has been suggested that this arises from the presence of a minute quantity of impurity in British iron; but chemical analysis barely permits, and certainly does not strengthen, this supposition. Are we not then justified in looking for other explanations, especially when the wondrous changes, induced by an altered molecular arrangement of particles, are duly considered? Some time ago a patent was obtained by Mr. Heath, for the introduction of a small portion of carburet of manganese into the melting-pot with cast-steel; and the result of this is, that steel, so melted in contact with manganese, will weld, either to itself or to common iron. Yet the most careful chemical investigations have failed to prove the existence of manganese in steel melted after Mr. Heath's method. Again, pure copper from the refinery, is highly crystalline, and incapable of being rolled or hammered into plates, unless it has undergone the mysterious process called "polling;" after which, its crystalline character vanishes, and it may be beaten into thin plates or leaves. Now in all probability the conditions which lead to the crystallization of copper, also tend to produce those of iron; and hence, instead of sitting with folded hands, under a belief that the brittleness of coal-made iron is irremediable, practical men should be on the alert, to discover a mode, which, like the polling of copper, may answer the end, though incapable of scientific explanation. It should not be forgotten that splendid fibrous iron is occasionally produced in the forges of this country, as a work of accident. But in nature there is no such thing as chance; and hence British iron ought always to be close-grained and fibrous. Few inventions of modern date would so largely repay a discoverer as this; and we have no hesitation in predicting that the cure, when found—and found it must be ere long—will prove an extremely simple and easy affair, like that of Columbus and the egg, or Neilson's hot-blast perhaps.

But few of our readers who have visited the department of Raw Materials in the Exhibition, can fail to have noticed the

splendid collection of copper ores arranged under Class No. 1. These ores convey a very correct idea of the source from whence the great mass of our commercial copper is obtained; consisting, as they do, almost exclusively of what miners call yellow ore or copper pyrites. In this mineral the copper is combined with iron and sulphur, which latter seldom reaches to less than 30 per cent. of the entire weight. In extracting copper from copper pyrites it is customary to burn off the whole of this sulphur, and permit the resulting sulphurous acid to pass away with the products of combustion from the furnace. But, to say nothing of the intolerable nuisance thus created, it has always appeared to us, that the waste of this sulphur is a great national loss, which ought, if possible, to be put a stop to. At Swansea alone, the sulphur thrown away in this manner cannot be less than 1000 tons per week; which, if converted into sulphuric acid (an extremely marketable commodity) would yield 2700 tons of that substance, worth at least £25000 sterling. Hence, the sulphur equivalent to £1,300,000 worth of oil of vitriol, is every year converted into "thin air" and lost, at Swansea, through want of knowledge or skill to devise a means of securing or arresting sulphurous acid. Now, although sulphurous acid cannot, practically, be condensed, yet nothing is easier than to convert it into sulphuric acid, which readily admits of condensation by steam or water alone; and hence we are wholly unable to palliate, still less to justify, this enormous extravagance. The mode of working mundic or sulphuret of iron is well known, and affords an exact analogy for guidance in the case of sulphuret of copper. The only assignable cause for the continued carelessness shewn, in reference to this valuable waste product, would seem therefore to arise from the profits already derived by the present process being sufficiently large to paralyze invention, and render economy unnecessary. Every chemist knows, that when a small quantity of nitric oxide is added to sulphurous acid, in contact with water and air, that sulphuric acid is the result; for this, in fact, constitutes the ordinary mode of making oil of vitriol. Moreover, as in the manufacture of oxalic acid, this nitric oxide is itself a waste product, it surely would be worth while to try the effect of mixing these two valueless gases in a horizontal flue, containing a thin stratum of water, or filled with pieces of pumice-stone or coke, moistened with that fluid. Suppose, for example, that the waste nitric oxide of an oxalic acid maker were admitted into the sulphurous flue of a copper works,—is it not extremely probable that such an amount of condensation would ensue

as to indemnify the trifling outlay and labor consequent upon so simple a process? It may be urged, perhaps, that sulphuric acid, so obtained, must always contain arsenic, and, therefore, prove inadmissible for some uses; but is not this already the case with sulphuric acid made from mundic, which invariably contains arsenic? We know that various plans have been devised for decomposing the sulphurous acid of copper works, by heating it in contact with hydrogen, or carbonic oxide gas, so as to deoxidize and reduce the sulphur it contains. But these are retrograde movements, and, consequently, more difficult than the onward motion which we have shadowed forth above: hence, perhaps, the reason why they have not been brought into practical operation on the large scale. Whether the means we have hinted at, be or be not the best adapted to secure success, is altogether a secondary matter; for our object goes no farther than to demonstrate the existence of a large yearly waste, and shew that a remedy is possible;—as to the practical details, they ought, properly, to come from another quarter.

The ores of lead stand, in the Exhibition, next to those of copper; and, as galena, the chief plumbiferous ore of this country, gives off sulphurous acid when roasted, our remarks might be supposed to apply equally in this case. But such a line of argument is not admissible, for many reasons, as regards lead; the only available improvement in the manufacture of which appears already to have been reached by the philosophical process of Mr. H. Pattinson, for the separation of the silver combined therewith. This beautiful invention has materially reduced the cost of separating these metals; and in the Exhibition there are several masses of silver, illustrating its employment in the various lead works of Great Britain.

TEXTILE MANUFACTURES.

The vast advances which have of late been made in this important branch of industry are so little known to the general reader, that it may be desirable, as an introduction to our remarks on the present improved state of our preparing and spinning machinery, to bring under review the condition of the textile manufactures in times past, and shew the nature of the several operations. If, in doing this, we should be led to greater length of detail than the subject would appear at first sight to demand, as being but one of many branches of industry represented in the Exhibition, we trust it will be

sufficient apology, that we are now writing, not so much for the information of the manufacturer, as for those who require that the difficulties attendant on the conversion of the raw materials of cotton, flax, silk, and wool, into woven fabrics, should be explained, in order to a right appreciation of the skill and ingenuity displayed in manufacturing the variety of elegant tissues which adorn the walls of the Crystal Palace.

The art of spinning and weaving, as proved by the sacred writings and the hieroglyphics of Egypt, is of the greatest antiquity. The implements originally used were necessarily of the rudest construction; and but little improvement was made in them until a period scarcely removed from the memory of the living. The distaff was the implement first employed for the production of yarns; and it is to this day in partial use in India, as will be seen by reference to the interesting models which have been contributed to the Exhibition by the East India Company, to illustrate the division of industry among the Hindoos. In later times, the spinning-wheel supplied the place of the distaff, but afforded little advantage over its predecessor,—inasmuch as the capability of the machine was still limited to the production of a single thread. The operation was carried on by the wives and children of cottagers, scattered over a great extent of country; and even at the present time yarn is obtained in this primitive manner in some parts of Scotland and Ireland. Of the kind of spinning-wheel now used, the Exhibition presents a few examples. One is contributed by Messrs. Nimmo and Sons, of Edinburgh, and another by Messrs. Roddy, of Belfast. The mode of operating with the primitive spinning-wheel was thus:—The fibrous material, brought to the state of a spongy cylinder by means of hand-cards, was attached at one end to a spindle, and seized at a short distance from the spindle by the thumb and first finger of the operator's left hand, and gradually drawn out, so as to extend its length, or produce what is now technically called a "stretch;" at the same time, the wheel, rotated by the right hand of the operator, caused the spindle with which it was connected to revolve, and impart a twist to the fibres of the material. By reversing the action of the wheel, and allowing the left hand to approach the spindle, the drawn and twisted portion of the fibre, now brought to a state of "roving," was wound upon the spindle; and by thus acting upon a given quantity of the material, and winding it up, a "cop" was produced. The roving itself was next submitted to the drawing and spinning process, and thereby converted into finished yarn.

The productive capabilities of the loom for weaving the yarns continued for ages very little in advance of those of the spinning-wheel; for, up to about the middle of the last century, its primitive mode of action was retained: the shuttle was thrown across the warp by hand; and in weaving the wider class of cloths, two men were required to govern the operation. About the year 1736, Mr. John Kay, a native of Lancashire, effected the throwing of the shuttle by mechanism, and drew upon himself the persecution which, until lately, usually attended those who dared to endow inanimate matter with powers which it was thought should be exclusively exercised by intelligent humanity. This invention, by increasing the capabilities of the loom, caused the demand for yarn to exceed its production to such a degree, that Mr. Guest, in his history of the cotton manufacture, states, "it was usual for a weaver to walk three or four miles in a morning, and call on five or six spinners, before he could collect weft to serve him for the remainder of the day; and when he wished to weave a piece in shorter time than usual, the gift of a ribbon, or a new gown, was necessary to quicken the exertions of the spinner." This state of things, however, was about to pass away; the sun of mechanical invention arose and discovered a mine of exhaustless wealth, by developing the capabilities of a manufacture, which, for the rapidity of its growth, and the effect upon our commercial relations, is unparalleled in history.

It is, as all the world knows, to the ingenuity and perseverance of Richard Arkwright, that we are indebted for the establishment of our cotton manufacture on its present extended basis. In 1771, Mr. Arkwright (afterwards Sir Richard) erected his first mill for the spinning of cotton yarn; at which time the amount manufactured is calculated to have been about equal to the production of 55,000 spindles of the present day; the number now employed being not less than 20,977,017*. This great increase, marvellous as its amount may appear, conveys, nevertheless, but a very inadequate idea of the value of the change effected by the mechanical facilities which are now in the hands of the manufacturers; for the same efforts of genius which have tended to multiply the use of cotton, have alike affected the consumption of flax, wool, and other fibrous tissues. With Arkwright's invention must be associated that of Hargreave's, which, in combination with its rival, constituted the ingenious machine now known as the

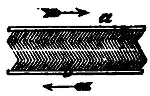
Parliamentary Return, dated 15th August, 1850.

"mule." The treatment to which the several fibrous materials used in the manufacture of woven fabrics are subjected by the spinner, is more or less varied; but as the cotton manufacture is a key to the textile manufactures, and may now be viewed in almost its entirety in the Exhibition, we shall select that for our main description.

Cotton or cotton wool, in its raw state, is a filamentous down, obtained from the plant *Gossypium.* Its fibres are of various length, and it cannot therefore be wound at once into a perfect thread, as silk is reeled from the cocoon. A number of these short and tender filaments have therefore to be laid side by side, and united at their ends to others, by twisting, so as to consolidate them in a continuous length;—this twisting of a number of fibres, arranged parallel to each other, is the process of spinning.

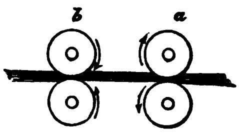
In order to facilitate the transport of cotton to this country, machines of great power are employed for compressing it into bales: on its arrival here, therefore, the first operation is to loosen the fibres from the hard entangled mass, and free them from extraneous matters: this operation is performed by a machine, known as the "willow." The Exhibition gives no example of this simple machine: it consists merely of a drum, furnished with radial spikes, and placed within a wooden casing. While this drum is revolving at the rate of about 6000 revolutions per minute, the cotton is fed into the machine, and the spikes, entering the interlocked fibres, separate them, and enable the heavy impurities to fall through a grating at the lower part of the machine. In order to complete the separation of the fibres, and perfectly cleanse them, the willowed cotton is passed through the "scutcher" or "blower." In this apparatus the material is delivered by an endless travelling-cloth to the beating action of rapidly revolving arms, placed within a casing, and beneath which there is a wire grating for the escape of dust thus liberated. The material is then usually submitted to the operation of another revolving beater, and drawn forward by an apparatus for the exhaustion of air on to the periphery of a revolving cylindrical cage, and, by accumulating thereon, forms a fibrous sheet, which being, by the action of the machine, wound upon a roller, constitutes, in technical language, a "lap."

Thus far the cotton has been freed from impurities, and a light disentangled condition obtained; the fibres are, however, still without a regular arrangement; and the object is now to submit them to operations which will straighten them, and lay them side by side. For this purpose, the "carding en-



gine" is first employed. The diagram in the margin will assist in the explanation of this process. Cards consist of a number of fine wires, of a staple form, and bent so as to form an angle to their base: they are secured in series to strips or sheets of leather. The diagram represents two carding surfaces so formed. The portions *a*, and *b*, are independent of each other, as regards their movements; and the wires are so arranged as to point to opposite directions;—if, therefore, a tuft of cotton be placed between them, and they be caused to travel in the directions of their respective arrows, the filaments will be combed out, so as to dispose their lengths in the direction of the motion of the cards. The diagram supposes the use of flat surfaces in the machinery employed; but, in fact, they are cylindrical,—a series of small rollers being set round a large central drum. The direction of the angular wires is so varied, as, at intervals, to strip the material from one surface to be transferred to another, and thus effect a frequent repetition of the straightening action. At the opposite side of the central drum to that where the feeding apparatus is situated, a cylinder, called a "doffer," is mounted, so as to run in contact therewith; and in front of the doffer is a rapidly reciprocating bar, called the "comb," extending across the cylinder,—the edge of which comb, by striking against the wire points of the doffer-cylinder, strips off the carded cotton in the state of a light fleecy sheet. The cotton, in this state, is next submitted to another carding process, or is at once conducted through a trumpet-shaped orifice, so as to narrow it into the form of a cord, light and spongy in texture: this cord, called a "sliver," is the yarn in embryo.

The cotton is next submitted to the action of the "drawing-frame," a machine of exceeding simplicity, but which, from its vast utility, formed the basis for Arkwright's success. The principle of its action will be understood from the diagram in



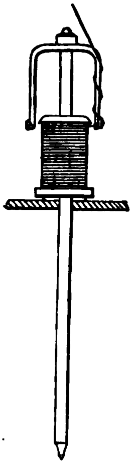
the margin. *a*, *b*, represent two pairs of rollers, equal in circumference, and revolving as denoted by the arrows. Now, supposing the spongy cord, as it is delivered from the carding engine, to be introduced between the pair *a*, and thence conducted to the other *b*, the revolution of these rollers, moving at the same rate, would carry forward the material, and deliver it in an unaltered condition; but, on increasing the speed of the pair *b*, without altering that of the rollers *a*, a tendency would be created to deliver the material faster than it was supplied.

It would thus become attenuated in exact proportion to the difference of speed between the two pairs of rollers, and would, therefore, be delivered from the machine in an elongated state. This beautiful and simple contrivance, it will be observed, is a transformation of the intermittent action, performed by the fingers of the hand-spinner, to that of a continuous movement: an admirable instance of the substitution of mechanical action for the tedious and imperfect operation of hand labor. By the drawing-frame, the fibres of the sliver receive a further straightening; and they are passed through the sets of rollers a number of times, according to the quality of yarn intended to be spun. Such repeated "drawing," however, would produce an attenuation too great for the subsequent processes, if means were not adopted for maintaining the substance. This is accomplished by combining a number of the drawn slivers together at each succeeding operation,—their incorporation compensating for their individual reduction, and also effecting an equalization of fibre. The extent to which this "doubling" and drawing is now carried, we shall have to speak of more particularly, in noticing the machinery and fabrics in the Exhibition.

The next machine to which the cotton is submitted, is the roving or slubbing frame; which, although commonly called a "preparation machine," performs, in fact, the first spinning process. We have seen the fibres of cotton brought into the form of a regular thread, but disposed uniformly in the direction of their length, and consequently possessing no tenacity. The future operations are for the purpose of gaining that quality by torsion. The roving or slubbing-frame effects this, but in a slight degree only; for the embryo yarn is yet in a coarse state, and must not be twisted to an amount which would prevent a further elongation at the spinning-frame. The machinery employed is of great complexity. The principle of action, however, may be easily explained; and a description of it will serve as a means of making the succeeding process intelligible. The material, as delivered from the drawing-frame, in the form of slivers, is received into cylindrical cans. These are placed behind the roving-frame, and the slivers they contain are conducted, in a doubled state, between pairs of drawing rollers, similar to those already mentioned. From these rollers, each compound sliver is conducted to a spindle and its appendages, to receive a slight twist. In the diagram *a*, is a revolving spindle, which carries, at its upper end, a "flyer" *b*, one of the legs of which is formed as a tube, provided with an aperture at the upper part.

The second leg is merely adapted for the purpose of counterbalancing the weight. Within the span of the flyer is a

bobbin *c*, mounted loosely on the spindle *a*. The sliver, passing from the can, and thence between the drawing rollers, is conducted through an eye, formed in the boss of the flyer, and down the tubular leg, to the bobbin, as shown by the dotted line. The revolution of the spindle and flyer will thus cause a twisting of the fibres of the material (the amount depending upon the number of revolutions, for a given length, delivered by the rollers), and lap the now twisted sliver, or roving, around the periphery of the bobbin. As the spindle, however, must revolve a certain number of times, for a given length of sliver, delivered by the rollers, according to the amount of twist required, the bobbin is also caused to rotate, but at such a relative speed, either in advance or behind the flyer, as to receive a continued winding of the roving. In addition to this rotation, the bobbins must traverse up and down the spindle, in order to distribute the successive windings throughout its length; and, as the layers become deposited, one upon the other, the diameter of the bobbin increases, which necessitates a corresponding decrease in the speed of the bobbin's rotation, to make it wind on the twisted sliver at a uniform rate. The mechanism by which these complex movements are effected, ranks amongst the highest efforts of mechanical



genius, and will afford the student ample compensation for the time occupied in their investigation. It is usual to submit the cotton to two operations, similar to the foregoing; after which, it is carried to the final process, technically distinguished as spinning. This is effected either by the "throstle" or the "mule,"—the latter being chiefly used for the production of the finer yarns. The "throstle-frame" consists of a series of spindles, flyers, and bobbins (one of which is represented in the margin), very similar to those of the roving-frame; the action of the machine being, in in fact, a repetition of the former operation; but, in this instance, a far greater degree of twist is imparted by reason of the increased velocity of the spindles, in proportion to the length of roving, passing, in a given time,

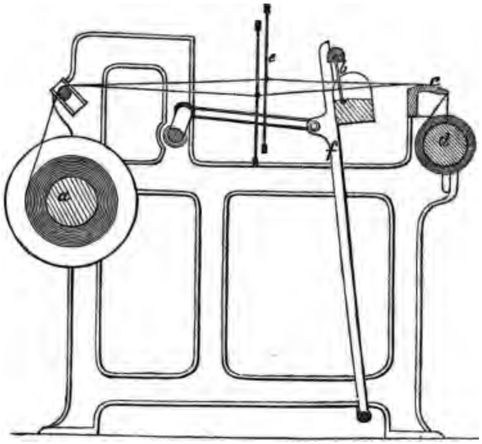
through the delivering rollers. As, however, the loose, fibrous strand, now under operation, was consolidated by a previous torsion, and thereby acquired sufficient cohesion to cause the bobbin to rotate by traction, and turn loosely upon the spindle, at the exact rate required for winding on the yarn, there is no provision in this machine for the differential driving motion before alluded to.

Mule spinning differs from that of the throstle, in not being continuous in its action. In the throstle it has been seen that the roving passes through the rollers, and is wound up, as finished yarn, uninterruptedly; but on the system of mule spinning, a series of spindles, with the rovings attached, are caused to recede from the rollers, by which the material is delivered,—revolving at the same time, so as to effect the necessary amount of torsion. Having thus travelled a certain distance, a retrograde motion takes place, during which the now twisted and finished yarn is wound upon the spindles; and, by such successive forward-motion for twisting, and backward for winding-on, the spinning is accomplished.

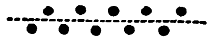
The above sketch will afford the reader a general idea of the operations necessary for the production of yarns from cotton. The treatment of wool and flax is substantially the same as regards the spinning, but is varied in some measure with reference to the preparation.

The longer sorts of wool, used in the "worsted manufacture," are disentangled and straightened by an operation of combing, instead of by the carding process; and a similar plan, called heckling, is adopted in the manufacture of flax. The short wools are prepared on the carding principle; and, although there are certain minor variations in treatment, the operations are essentially the same as those in use for cotton.

The general nature of the processes for producing yarns being understood, we will now briefly notice the manner of working them up in the loom. All fabrics, woven in the loom, consist of warp and weft-threads, interlaced or platted together: the former extend along the length of the loom, and the latter are shot across it In the annexed diagram, which represents a loom in longitudinal section, *a*, is called the "warp-beam," upon which a series of threads are wound. These threads are severally passed through eyelet holes, carried by suspended strings *e*, termed the "harness," and are thence conducted through a series of interstices, formed by a number of thin pieces of metal *b*, termed the "reed;" beyond which they are carried over the breast-beam *c*, and attached to the cloth-beam *d*. By alternately raising and depressing the two divisions of the harness, a space, termed a "shed," is formed



between the warp-threads; and through this shed, the shuttle, which carries the weft, is driven. The shuttle runs in a "race," carried by a vibrating-frame *f*, called a "batten," to which also the reed *b*, is attached. The hatched and the black



circles in the figure represent the warp, in the position to form a shed: if the shuttle be now thrown across the loom, a thread will be left between the two tiers of warp, as shewn by the dotted line;—a motion of the harness *e*, then taking place, the lower warp-threads will be raised, and the upper ones depressed. The reed, after every movement of the shuttle, comes forward and beats up the weft-thread; and by a succession of such movements an interlacing of the weft with the warp is effected, which constitutes the principle of weaving:—a slow rotary motion is given to the work-beam *d*, to cause it to wind up the cloth as it is woven. It will be evident that the two tiers of warp-threads may be divided in a variety of forms;—two or more threads adjoining each other, may, for instance, occupy a place in the upper rank at one throw of the weft, and take a different relative position at the next throw; and be so varied, according to a previously determined plan. It is upon this principle that the weaver operates, to produce the pattern in textile fabrics.

The reader will now be prepared, on entering the department of "Machinery in Motion," to understand the main features of the splendid collection of preparing, spinning, and weaving machines, contributed to the Exhibition by some of the first makers in the United Kingdom.

MUSICAL INSTRUMENTS.

MUSIC, although possessing many features in common with the sister arts, has this remarkable peculiarity, that it is in great part dependent on a branch of manufacture, requiring in a high degree the exercise of technical knowledge and mechanical skill. It is due to this circumstance alone, that while poetry, painting, and sculpture attained high excellence at an early period, music is still progressing. The contemporaneous improvement of musical art and of musical instruments has never, we think, been sufficiently noticed; but when we consider that musical instruments are the medium through which the composer makes known his ideas, we find at once a reason for the gradual development of this most enchanting art, as well as a stimulus for increasing the capabilities of the means on which it mainly depends for its expression.

To trace the manner in which the progress of music, and the growth of mechanical ingenuity, have gone on, hand in hand, would be indeed a pleasing and instructive task; but it is out of our province to undertake it here. Our business is with manufactures, and with the Exhibition of 1851. Let us, therefore—having thus briefly alluded to the intimate connection of this branch of manufacture with the art itself—proceed to examine what is its state of advancement in the present day,—noticing what progress has already been made, and what glimpses the World's Fair gives us of improvement to come.

The *Piano-forte* is by far the most valuable musical instrument we possess. It is indeed inferior in particular points to many others, but has on the whole important advantages over all. For example, it is not equal to the organ in power, grandeur, or variety of tone; but while this colossal instrument is calculated only for a permanent fixture in the church or the chorus hall, and requires, moreover, skill of no common order to play, the piano-forte is portable, is admirably adapted for the requirements of private life, and is, perhaps, more easily mastered, to a certain extent, than any other instrument known. Again, although the piano-forte lacks the exquisite delicacy of intonation and amazing power of expression of the violin tribe, and has but a limited capability of producing sustained tones, yet it possesses the advantage of being a miniature orchestra in itself, capable of executing music in every variety of style, and even of representing, with tolerable precision, all the effects producible by the complicated and expensive machinery of a full band.

It will be our object, first, to describe, as briefly as possible, the construction of the piano-forte, in order to shew the peculiarities of the manufacture, as carried on in the present day; and we shall then proceed to enumerate the examples contained in the Exhibition, offering such remarks upon them as may naturally suggest themselves. It will be interesting to notice, as we proceed, the gradual improvement of the various parts of the instrument; and, in so doing, we may have occasion to allude to some few particular inventions; but it must be borne in mind that in this, as in many similar cases, the gradual advance has rather been due to the combined efforts of many intelligent minds, and to the results of combined experience, than to the isolated improvements of individuals.

Musical instruments, in which the tones were produced by keys, acting upon stretched strings, are of considerable antiquity, but the piano-forte, properly so called, is an invention of the last century; and it is a curious fact, that many great compositions which now afford useful exercises for this instrument (such as the *Suites* of Handel, and the *Clavecin bien tempéré* of Bach) were written before it was in existence. The instrument that immediately preceded the piano-forte was the *harpsichord,* in which the wire was twitched by a small tongue of crow-quill, attached to an apparatus called a *jack,* moved by the key. The tone thus produced has been not inaptly described as a scratch with a sound at the end of it: the instrument, although great ingenuity was displayed in its manufacture, was very monotonous, and afforded the player no scope except for execution, and that of a most mechanical and soulless kind. At length, in an auspicious hour for the interests of music, the idea arose that, by causing the key to *strike* the string, instead of pulling it, the tone might be considerably improved, and the general capabilities of the instrument otherwise extended. This contrivance opened an entirely new field to the player, by giving him the power of expression, in addition to that of execution; for, by varying the touch, a greater or less degree of force could be given to the blow on the string,—whereby the effects of *piano* and *forte* might be produced at pleasure. This was the great feature of the new invention, and gave to the improved instrument the name of *piano-forte,* which it has ever since retained. Who was the inventor, does not appear certain. The merit has been ascribed by turns to the Germans, the Italians, and the English; and the date of the invention is equally obscure. The first authentic notice of the instrument we have been able to discover is on the occasion of a visit of John Sebastian Bach to Frederick the

Great, King of Prussia, in 1747, three years before this immortal composer's death. The king had been so much pleased with certain "forte-pianos," manufactured by Silberman of Freyburg, that he bought them all up, to the number of fifteen, and placed them in different rooms of the palace. When Bach arrived, the king gave up a concert about to take place, and spent the evening in hearing the great man play on these forte-pianos; and it was on this occasion his Majesty gave Bach the subject of the well-known "Musicalisches Opfer." It is said that the instruments are, or were a short time ago, still existing on the premises; but it is probable they did not subsequently answer the king's expectations, for it is on record that a harpsichord of the best kind was made to his express order eighteen years afterwards, namely, in 1765, by Tschudi, the predecessor of the present firm of Broadwood and Sons, and at that time one of the principal harpsichord makers in London.*

We have evidence that the piano-forte was first known in England about 1767, inasmuch as it was introduced on the stage of Covent Garden Theatre, as "a new instrument," in May of that year.† The manufacture of the new instrument was soon commenced by the harpsichord makers, whose ingenuity wrought great improvements in its construction, and made manifest the great capabilities of the new principle. A German maker, of the name of Backers, is supposed to have been the first who manufactured the piano-forte to any con-

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* An excellent portrait, by Hogarth or one of his pupils, now on the premises in Great Pulteney-street, represents Tschudi in the act of tuning the royal harpsichord. The instrument is still in the palace at Potsdam.

† This evidence is derived from an old play-bill, a copy of which is now in the possession of Messrs. Broadwood. It contains many well-known names, and as it is otherwise a very interesting document, we have been enabled, by the courteous permission of Messrs. Broadwood, to give it entire. It runs as follows:—

By particular desire.—For the Benefit of Miss Brickler.

THEATRE ROYAL IN COVENT GARDEN.

On Saturday next, being the 16th of May, 1767, THE BEGGARS OPERA.—*Captain Macheath*, by Mr. Beard; *Peachum*, by Mr. Shuter; *Lockit*, by Mr. Dunstall; *Filch*, by Mr. Holtom; *Player*, by Mr. Gardner; *Beggar*, by Mr. Bennet; *Mat o'the Mint*, by Mr. Baker; *Mrs. Peachum*, by Mrs. Stephens; *Diana Trapes*, by Mrs. Copin; *Mrs. Slammekin*, by Mrs. Green; *Polly*, by Miss Brickler; with a Hornpipe by Miss D. Twist; and a Country Dance by the Characters in the Opera.

End of Act I., Miss Brickler will sing a favourite Song from Judith, accompanied by Mr. Dibdin, on a new instrument, called PIANO-FORTE.

To which will be added a FARCE, called THE UPHOLSTERER.—*The Barber*, by Mr. Woodward; *Feeble*, by Mr. Murden; *Bellmour*, by Mr. Perry; *Rovewell*, by Mr. Davis; *Watchman*, by Mr. Weller; *Quidnunc*, by Mr. Dunstall; *Pamphlet*, by Mr. Shuter; *Harriet*, by Miss Vincent; *Maid*, by Miss Cokayne; *Termagant*, by Mrs. Green.

Tickets to be had of Mr. Sarjant, at the Stage-door, where places for the Boxes may be taken.

siderable extent in England, and, to his exertions, it is believed, many important improvements are due. The name-board of a grand piano-forte is still in existence, bearing the inscription "Americus Backers, Factor et Inventor, Jermyn-street, London, 1776." The manufacture was also early taken up by Tschudi, Stodart, Kirkman, Zumpe, and others, and its superiority soon became so apparent, that it gradually superseded the older and more imperfect instrument—the harpsichord—which, within the short space of ten or fifteen years after the introduction of the piano-forte, entirely ceased to be made. A suitable style of music, and school of players for the new instrument, were not long wanting; Muzio Clementi founded both. He played in public on the grand piano-forte at an early period of its history, and from that date its progress in public favor was rapid. Clementi's successors worthily followed in his steps: finding new wants arise, from time to time, they demanded new improvements to satisfy them; and thus the player and manufacturer vied with each other in the general advance.

The piano-forte appears usually in three forms, called respectively, the grand, the square, and the upright. In the two former, the strings lie horizontally; in the latter, they are placed vertically.

The grand form, suggested naturally by the varying length of the strings, was an early shape in which the piano-forte appeared, being, in fact, the same as that of the harpsichord. It is well adapted for durability, admits of the introduction of the best kind of mechanism for the action, and is, in short, the most advantageous form in many points of view; it is, therefore, invariably adopted for instruments of the first class. The grand piano-forte has three strings to each note, and is an expensive class of instrument. In order, however, to bring the advantages of this form more within the reach of the public, different modifications have been contrived, to save expense; and, in some instances, with the additional object of occupying less space. Thus, the *bi-chord* and *semi-grand* have but two strings to a note instead of three, and are cheaper in consequence; while the *boudoir* or *cottage* grands have much shorter strings, and take up still less room.

The oblong rectangular piano-forte, commonly called the *square*, was made at an early period; its form was taken from that of the German clavichord, and it was, probably, the first shape in which the piano-forte appeared. It remained, however, an inferior class of instrument until the adaptation to it of the improved action belonging to the grand, which

gave rise to the variety called the *grand square;* and, as thus improved, it is perhaps the best substitute for the grand. The form is, however, objectionable on mechanical grounds; it is very difficult to strengthen in the framing, and the oblique position of the action, with regard both to the strings and the key-board, is unfavorable on many accounts to the perfection of the instrument.

The *upright* form of piano-forte has had several phases. At first it was a grand, set on end, and raised on legs about two or three feet above the ground, the strings being struck at the lower end. This form was called the *upright grand;* but its unwieldy height soon led to its disuse, and another form was adopted, called the *cabinet,* in which the frame of the piano-forte was brought down to the ground, the blow being given at the upper end of the strings, through the medium of levers and long vertical rods, communicating from the key to the hammer. The cabinet piano-forte was introduced in the early part of the present century, and, being an elegant piece of furniture, had, down to a late period, a large sale. The principal drawbacks to its use are, first, its height (usually about six feet), which prevents it from being placed anywhere in a room, except against a wall;—a position often inconvenient and disagreeable to the performer, especially for singing;—and, secondly, the length of the action, which interferes considerably with the delicacy and ease of the touch. To remedy these defects, shorter kinds have been made. About 1812, Mr. Robert Wornum introduced an upright piano-forte, which he called the "Harmonic," but which is now generally designated as the *cottage,* varying from about four to five feet high; and, in 1827, he made a shorter kind still, called the Piccolo, standing only about three feet six inches from the ground. This has served as the model for many others under different names, of about the same size. The small upright piano-fortes, as now made by the best houses, are very good instruments, and are valuable for small rooms, from the little space they occupy, and the facility with which they can be placed in any desired position. The upright form has the peculiar advantage, that the strings are struck *against* their rests, which is generally considered the most favorable direction for the blow. Many attempts have been made to apply this method of striking to the grand and square forms; but it has not yet come into general use.

The *compass* of the piano-forte was originally five octaves, viz., from the F below the lowest note of the violoncello, to the fifth F above. After some length of time it was extended

upwards to C, making 5½ octaves; and piano-fortes, so made, were said to "have the additional keys." As the manufacture and the music improved, another half-octave to F was added in the same direction; and, subsequently, for the better class of instruments, half an octave in the bass, down to C. Another note was finally put on in the treble; and the compass thus arrived at, namely, from CCC (called, on the organ, sixteen-feet C), to G, 6½-octaves* above, is the general compass of the piano-forte at the present day. Some grand pianos are made seven octaves, from A to A, or from G to G; one in the Exhibition, made by Mott, has 7½ octaves, from F to C; and M. Pape, of Paris, has made them eight octaves, from E to F; but it is doubtful whether more than 6½ will be generally used. A considerable advantage, attendant on the increase of the compass of piano-fortes is, that the extra size of the sound-board improves the power and tone of the instrument generally.

In remarking now more minutely on the construction of the instrument, it may be well to bear in mind, that the piano-forte, whatever its shape, consists of four distinct parts, viz., the framing and sound-board,—the stringing,—the keys, and machinery attached for striking the strings (technically called the action);—and the ornamental case, covering the whole. The latter of these belongs to cabinet manufacture, and will be treated of under the head of "Decorative Art." The other three we will take *seriatim.*

The *framing* of the piano-forte is a part of the utmost importance, as upon its strength depends entirely the durability of the instrument, and its power of standing in tune. Its principal use is to serve as a strut or stretcher between the two ends of the system of strings, and to keep them apart from each other; and, as the tension of the strings, in a full-sized grand piano-forte, amounts to 11 or 12 tons, or about 25,000 lbs., it may easily be conceived, that the strength of the framing, necessary to resist this force, must be very considerable. Formerly, this framing was constructed of timber only. The strings were looped at one end upon studs, driven into a solid block of wood, which we may call the string-block; while their other ends were wrapped round a series of

* Makers usually call this compass 6¾ octaves; because, having described the former compass, from C to F, as 6½, they have thought it advisable to add a ¼ octave for the increase of two semi-tones. They should, to be consistent, add two semi-tones more, and then call the compass, from C to A, seven octaves, which would be an excellent *reductio ad absurdum.*

iron pins, called wrest-pins,* and inserted into another bed of timber, called the wrest-plank. The string-block and the wrest-plank, thus carrying the two ends of the strings, were kept apart by a framing of carpentry, trussed in such a manner as to offer the best conditions for resisting the tension. But, however ingeniously this trussing might be contrived, or however carefully seasoned the timber of which it was composed, it was found insufficient in strength, and subject, in course of time, to give way and become distorted in shape under the immense strain,—causing the piano-forte to lose its permanence of pitch, and to get out of tune. Moreover, the want of reliance on this part of the instrument prevented the introduction of heavier strings, which the makers, urged by the general call for improvement, were desirous of adopting, in order to increase the power, and augment the tone. At length the idea arose of strengthening the framing with the more permanent and stronger material—metal; and a series of improvements were made, which have resulted in the compound wood and metal framing, now used, with slight modifications, by all makers; and which, in its general features, as applied to the grand piano-forte, may be described as follows. The studs, upon which the back ends of the strings are secured, instead of being driven into a wood block, as formerly, are now attached to an iron plate, curved to the form of the hollow side of the instrument, and called the *string-plate.* From this plate, metallic bars are extended longitudinally above the strings, and parallel with them, to the wrest-plank; their ends being so firmly connected with the string-plate and wrest-plank respectively, as to take upon themselves, in a great measure, the force of tension of the strings. At the same time, the string-plate, being screwed firmly down to the timber-framing below, and the metallic bars also secured thereto at intervals in their length, the whole forms one strong combined trussing, in which both wood and iron contribute to the strength. The bars and string-plate are usually of wrought-iron or steel. The principal parts of the wood framing are composed of the best and soundest oak, thoroughly seasoned and dried, and "glued up" in several thicknesses, by which greater permanence of form is secured.

It will be noticed, on inspecting a grand piano-forte, that the wood-framing under the strings is, of necessity, severed com-

* These are often erroneously called *rest*-pins; but the orthography in the text is the true one; the word *wrest*—"to twist by violence"—referring to the action of drawing up the strings in tuning.

pletely across by the opening through which the hammers rise to strike the under side of the wires. To convey the thrust across this chasm, small thin arches of metal are interposed, abutting on one side against the wrest-plank, and on the other against a transverse rail, forming a portion of the main body of the framing, and called the belly-rail. This interruption to the continuity of the under framing, is a great but unavoidable inconvenience, and did it not exist, probably the aid of the metal bars might be dispensed with altogether.

The part that various makers have taken in the introduction of the metallic bracing, has been much discussed; several have contributed to it, and probably much was suggested by the important part which iron, under the auspices of the engineering profession, began to take in the constructive arts at the commencement of the present century. It appears that, as early as 1808, Messrs. Broadwood applied metal tension-bars to the treble;—that in 1820, Mr. Stodart patented the first perfect system of metallic bracing for grand pianos, consisting of the string-plate and bars united;—and that between this date and 1827, other makers applied various modifications of this system, which resulted in the general plan now in use.

Messrs. Broadwood adopt, in some cases, a metal bar running transversely over the wrest-plank, in a direction nearly at right angles to the longitudinal bars, and secured firmly thereto. From this transverse bar, a set of screws descend into the wrest-plank; the object being to hold this part of the frame more firmly in its place, and thereby to insure the stability of the instrument and the steadiness of the tone. When this bar is added, the number of longitudinal bars is reduced from four or five to two. The same firm have also lately adopted another system of metallic bracing, the peculiarity of which is that some of the tension bars, instead of running parallel with the strings, are placed diagonally. Specimens of both these varieties are in the Exhibition. The surface of wood lying extended immediately under the strings is called the *sound-board*, and to it is due, principally, the tone of the instrument. It is analogous to the belly of the violin, and is composed of a thin boarding of the best Swiss pine, perfectly free from knots or imperfections, cut in a particular direction of the grain, and thoroughly seasoned. It is strengthened on the under side with small ribs, and put together with the utmost care. The edges of the sound-board are attached to the framing of the instrument, the whole of the middle part being left perfectly free to vibrate, under the impulse received from the percussion of the strings.

In the square piano-forte, the framing is more difficult to make strong than in the grand, in consequence of the separation of the wrest-plank from the string-plate, by the wide and deep space required for the keys and action. The strengthening is principally effected by bolting the wrest-plank and string-plate firmly down to a strong bed of timber, extending underneath the keys over the whole surface of the instrument, and forming thereto a thick solid bottom. In addition to this, one or two metallic bars are, in the best instruments, stretched across from the string-plate to the wrest-plank, over the strings, and parallel to them.

The framing of the upright piano-forte is the simplest of any, in consequence of its continuity being perfect, that is, unbroken by any openings. The tension is taken by strong struts or bars of timber placed, vertically, at the back of the instrument, to which the wrest-plank and string-plate are firmly secured; so that the force of the tension is resisted by the bars in the direction of their length: they are, in fact, simple columns, and receive their load in nearly the same manner as pillars supporting a building. Iron bracing has sometimes been adapted to the back of the framing of the upright piano-forte, to counteract the pull of the strings on the opposite side.

The *stringing* of the piano-forte claims some attention. The strings were originally formed of much thinner wire than is now used, the treble being of steel, and the bass of brass. For the lowest notes of all, however, strings of simple wire could not be made long enough to give the grave tone, and it was necessary to use lapped wire, *i. e.*, a brass wire, wrapped round with a thinner one of copper; the effect of this being to make the string vibrate slower, and give a more grave sound. Each string was formed of a separate wire, one end of which was twisted into a loop, and passed over the stud in the string-block; the other end being wrapped round the wrest-pin. In the course of the general improvement of the piano-forte, a demand arose for heavier wires, capable of resisting a forcible blow (which formerly caused the thin strings to jar against each other), and giving out a better quality of tone. But here arose the necessity for a new method of fixing the string, it being very difficult to form the loop with sufficient security in the thicker wire. This gave rise to the modern method of stringing, according to which one wire, of double length, is made to form two strings. The two ends are wrapped round two adjoining wrest-pins; the middle of the wire being bent over a stud in the string-plate, at the opposite

end of the instrument. The pressure of the wire on the stud is sufficient to keep both strings distinct, as regards their tuning. This method of stringing was invented and patented by Messrs. Collard, in 1827, and is now (the patent having expired) almost universally adopted.

Another improvement, applied to the stringing of grand piano-fortes, is that of the upward bearing of the strings at the striking end. The length of the vibrating part of the string is determined by two bridges, over which each wire passes; one fixed to the sound-board, the other to the wrest-plank, a little in front of the striking point of the string. Now the original plan was, so to arrange the levels of these two bridges, with reference to the ends of the wire, that the string might, when stretched, have a downward pressure upon both. But, since the hammer strikes upwards, it is evident that a heavy blow must exert a tendency, more or less, to lift the string off its bearing; the effect of which is considered detrimental to the tone. On this account the direction of the bearing on the front bridge was reversed, or rather the bridge itself was changed for a plate pierced with a series of holes, through which the strings passed, turning immediately upwards towards the wrest-pins. This gave each string an upward instead of a downward bearing at the front end; the effect of the blow being, under these altered circumstances, to force the string against its rest instead of lifting it from it, as before. The upward bearing is claimed by Messrs. Erard, as having been described by them in a patent of 1808, and modified and improved in 1821.

The strings used now are entirely of steel wire, brass having been abandoned as too soft and weak for the purpose. The lowest octave in the bass is of lapped wire, but differently constructed to that formerly in use; the main wire is of steel; the wrapping wire is of soft iron for the upper part of the octave, and of copper for the lower. The wrapping too is close, like that of the fourth string of a violin; whereas, formerly, it was open, like the worm of a corkscrew. In the lowest bass notes of grand pianos, where the copper-lapped strings are of considerable diameter, two are considered sufficient, and some makers prefer only one.

The best piano-forte wire is made, expressly for the purpose, by Mr. Webster, of Penn's Mills, near Birmingham.

The "*action*" of the piano-forte is understood to mean the machinery through which the impulse given by the finger of the performer is transmitted to the string. We have hitherto been considering parts at rest, whose peculiarities

consist in their statical qualities; this is the moving part;—the mechanism, whose nature is strictly dynamical. The importance of the action will be evident, when it is considered that its office is to convey, so to speak, the very mind and will of the player; and upon its excellence depends entirely the capability of the instrument to answer to the ever-varying shades of expression which the genius or skill of the performer may prompt him to impress upon the keys.

The earliest actions were very rude: the first was nothing more than a piece of bent brass wire, fixed into the back end of the key, which struck the wire when the front end was thrust down; next, a piece of wood, possibly covered with leather, took the place of the wire; and then came the first real improvement, the addition of the hammer, a separate lever for striking the string, by which a greater extent of motion was obtained, and a more effectual blow given than by the former plan. The hammer was lifted by an upright wire, attached to the back end of the key, and capped with a leather button, which came in contact with the under side of the hammer. The height of this button was so adjusted, that when the key was pressed down as far as it would go, the hammer was a short distance from the string; the effect of this adjustment being that, after the impulse given to the hammer had caused it to strike the blow, it fell back upon the button, and so left the string free to vibrate. This was called the "single action." It was the simplest form of mechanism, and probably the earliest that obtained for the piano-forte any share of public favor. Square instruments were made with this action as late as the commencement of the present century, and probably many of them are in existence still.

The next improvement was the introduction of the "hopper." The evil of the single action was, that owing to the adjustment already mentioned, the hammer would not reach the string, unless the key were thrust down with sufficient force to give it considerable impetus;—so that it was impossible to play very *piano;* while if, to remedy this evil, the adjustment of the button was altered, to bring the hammer nearer to the string, there was a danger of its not leaving it after the blow—a defect technically called "blocking." The hopper removed this evil. It was a jointed upright piece attached to the back end of the key, and used to lift the hammer, in place of the stiff wire and button of the former mechanism. When the key was pressed down, the hopper, engaging in a notch on the under side

of the hammer, lifted it to within a very short distance of the string—so near, in fact, that almost the slightest pressure would cause it to strike; but at this moment, while the key was still pressed down, the jointed part of the hopper coming in contact with a fixed button as it rose, escaped from, or "hopped" out of, the notch, and let the hammer fall clear away from the string. This mechanism, as applied with trifling variation to the square piano-forte, was called the "double action," and is extensively in use for this and the upright form at the present day.

The next improvement was the "check," which we must introduce as before by explaining what was the evil it was intended to cure. The hammer, when liberated from the hopper, fell upon a rail covered with cloth or some other soft bed prepared to receive it: now, when a forcible blow was struck, there was always a danger of the hammer rebounding,—or, in other words, the elasticity of the struck wire would send it down with such force, that it rebounded from its bed, touched the string a second time, and so damped the vibration and injured the tone. The remedy for this was found in fixing to the back end of the key a projection called a *check,* which caught the head of the hammer as it fell, and held it down so firmly that it could not again rise. The check was one of the most important additions ever made to the action; and no piano-forte, of any pretensions, is considered complete without it.

The whole of these improvements were made at a very early period in the history of the piano-forte. To whom we are indebted for them appears uncertain. Some accounts state that the hopper was patented by Longman and Broderip (the predecessors of Clementi and Co., now Collard's); but there is a tradition that, when the manufacture of the instrument was taken up by Backers, he himself, in conjunction with Mr. Broadwood and Mr. Stodart (both then young men, just embarking in the business), devoted much time privately to the improvement of the mechanism; and that the joint production of the three, when made public (probably about 1770), was the perfect action, known in England as the "grand action," and on the continent as "*die englishe Mechanik,*"—being the combination of hammer, hopper, and check, above described. It has been ever since in use; and, with only one further improvement, forms now the simplest and best action known.

This last improvement is called the "repetition" mechanism; and its object may be thus briefly explained. In the

ordinary action, after the hammer has fallen, the key must rise to its position of rest before the hopper will engage again in the notch of the hammer, so as to be ready for another stroke; and hence a note cannot be repeated without not only requiring the finger to be lifted through the entire height of the key's motion, but also demanding a length of time between the repetitions, sufficient to allow of its full rise. The contrivances by which this inconvenience has been overcome are of various kinds, according to the fancy or the ingenuity of the makers; but they all act on the same principle,— namely, by holding up the hammer at a certain height while the key returns; by which means, the hopper is allowed to engage itself under the hammer earlier, and to reproduce the note in less time, and with less labor to the finger, than before. There was at one time a great rage for repetition; and demands were made for it to be carried to an almost absurd extent; but this has now calmed down, and the public are beginning to find that simplicity and general accuracy in the construction are of far greater importance than a *soi-disant* refinement, which, carried to an extreme, has often degenerated into the mere gratification of a whim of the player. Hence, while the repetition movement is still retained, its operation is confined within reasonable bounds, and not allowed to interfere, as it formerly did, with the simplicity and other good qualities of the machinery in general.

The action of the piano-forte has afforded unlimited scope for the ingenuity of the manufacturer; and almost every maker of note has his own pet mechanism. In the best instruments they all consist, however, of the same essential parts, more or less modified in their shape or arrangement, viz., the hammer, the hopper, the check, and the contrivance for repetition. We cannot particularize even all the good actions, saying nothing of the indifferent varieties, but will merely mention a few in most common use.

Messrs. Erard patented a repetition action so early as 1824, which they have continued to use ever since; and a model of which is in the Exhibition. It is exceedingly ingenious, but the arrangement of levers, springs, &c., is very complicated. It consists (excluding the damper apparatus) of no less than seven pieces in motion, and contains seven joints; and, after all, we confess ourselves at a loss to see what results are obtained by it which may not be produced by much simpler means. For these reasons, although it has long been public property, no maker, as yet, has ventured to adopt it, except the firm to whom it owes its rise.

Messrs. Broadwood patented, some years ago, a mechanism (the invention of Mr. Southwell), to which they gave the name of the "Victoria repetition;" but they have since laid this aside for a simpler mode of producing the same effect. It differs only from the original simple form of grand action, in having a piece of bent wire attached to the hopper, which, acting on the tail of the hammer as the key descends, keeps it elevated, and so gives the repeating power. This action has but four moving pieces and three centres of motion. A model of this is also at the Exhibition.

Messrs. Collard patented an action in 1827, the invention of Mr. James Stewart, in which the hopper was modified in shape, and in the manner of its escapement. In 1843, they added, also under patent, a contrivance for repetition, consisting of a slight wire-spring, projecting from the hopper, so as to catch the tail of the hammer as it fell. This action is also simple, durable, and effective in its operation.

Several English and French makers, among whom may be named Messrs. Stodart, Wornum, Kollman, and Pape, have bestowed much labor in contriving a system of action for striking the strings downwards instead of upwards. Many advantages attend this plan, particularly the avoidance of the opening in the framing and sound-board, necessary, in ordinary horizontal instruments, for allowing the hammers to rise, and to which we have already alluded; and there is no doubt that, if the downward action could be made to work well, the construction of the grand and square forms of piano-forte would be much simplified, and their cost much reduced. The difficulties and inconveniences attending the reversed form of mechanism, have been, however, hitherto considered, by the majority of makers, as outweighing the advantages gained. Several specimens of down-striking actions are in the Exhibition.

After all, the great criterion of excellence, in a piano-forte action, is the degree of care bestowed on its construction, and the accuracy with which it is finished and adjusted. With these, almost any action, correct in principle, may be made to work satisfactorily; without them, the utmost ingenuity, or refinement in the mechanical contrivances, is entirely thrown away.

The covering of the face of the hammer was formerly of buff leather; now it is made of a fine kind of felt, prepared expressly for the purpose, which gives a much superior quality of tone. The change was first made by M. Pape, of Paris.

We have said nothing, hitherto, of the "damper," a simple

contrivance for stopping the vibrations of the strings, when the fingers are lifted from the keys. It consists of several folds of soft cloth, which press against the string when at rest, but are lifted off by the back end of the key when the front end is pressed down. The grand piano-forte damper consisted, originally, of a simple rod, headed with cloth, and rising vertically between the strings. But little alteration has been made in this, except that, as the strings were made heavier, and the vibration became stronger, the force with which the damper was held against the string, required to be increased, and the damping surface of cloth extended. The dampers are sometimes made to act above the strings, sometimes below them. Either plan appears to act equally well; but the former is the more simple of the two, as the damper then is raised directly by the end of the key, and is kept down by its own weight; while, on the other plan, the intervention of a lever and spring is necessary. The damper of the square piano has undergone more frequent changes. At first, it was a wooden lever, lying horizontally over the strings, having a bit of cloth at one end, and lifted by a vertical sticker. Next, a variety was introduced by Messrs. Broadwood, called the "brass damper," a brass lever acting under the strings, the weight of one arm of which kept it in action. Thirdly, came the "Irish damper," an upright one, worked directly from the back end of the key, which was soon modified into the "crank damper," by attaching it to a separate lever below. In 1827, Messrs. Collard patented an arrangement, in which the vertical wire was made to rise at a distance of three semi-tones behind the strings actually struck, the head being elongated this distance forwards. In the old system, the damper wire, rising close by the side of the vibrating strings, was apt to jar against them—an evil which this improvement removed. The setting back of the damper wire also gave room for adapting the check (formerly used only in the grand action) behind the hammer, and thus originated the improved form of instrument called the "grand square." In common squares, the old crank damper is still used.

Want of space compels us to postpone the remainder of our remarks on piano-fortes till next month, when we shall give some statistics of the manufacture, and then proceed to describe the novelties in the Exhibition.

LABOR-SAVING MACHINES.

PERHAPS there is nothing which more truly indicates the character of a people, as regards its energy and enterprize, than the means which it possesses of economizing labor. In the infancy of a community, we find that the value of time is unappreciated, because the wants of men are few, and may readily be supplied;—as population increases, the first step towards civilization is shewn in the regular and systematic application of some portion of the people (usually slaves) to the most laborious occupations; then follows the more general diffusion of industrial habits—but still animal power and manual dexterity are alone brought into requisition. To this point the Egyptians, Greeks, and Romans, advanced; and it was through the like gradations that the nations of modern Europe passed to the attainment of their present state of civilization. There is, however, this distinctive mark between ancient and modern civilization, viz., that, under the former, the distance between the intellectual and the laboring classes increased in exact proportion as a taste for science and the fine arts became prevalent; whereas, under the latter, the bond of union between all classes grows stronger as science and the arts progress. The explanation of this fact is easy, and brings us at once to the consideration of that interesting portion of the Great Exhibition which we propose to treat of under the general title of "Labor-saving Machines." It is simply this:—When the means of satisfying the physical wants of mankind is dependent solely on manual labor, the limit of this power entails the necessity of a wide distribution of labor; and as members of a community are drawn off to intellectual pursuits (which, in the case of the ancients, were unproductive), the work of the husbandman and the mechanic consequently thickens;—the one class may rise to demigods in wisdom; but the other will inevitably sink into slavery. At the present day, however, the elimination of new truths in natural science releases the laborer from his most arduous duties, calls forth the powers of his mind instead of those of his body, and multiplies a thousandfold the means of producing. Machinery, therefore, is an essential, in the attainment of a proper civilization—not merely from its capability of enriching the community, but because, without it, intellectual enjoyments must ever be beyond the reach of the lower orders; and, for this reason, it is highly desirable that it should be made to assist in all

kinds of labor. The Exhibition affords various examples of its application to what might not inappropriately be termed, "domestic manufactures;" and, under the title adopted above, which must be read as excluding "tools," and all machinery used in the staple manufactures, we shall notice such machines only as have been recently applied to displace or assist hand labor, or have been called into existence to supply some newly-discovered want. It will at once be seen, that, in treating of such a miscellaneous collection of materials, little method can be observed; but so much arrangement as our subject admits of it shall receive. With this view we will take consecutively the most important of those machines which have relation to paper. And first, the envelope folding machine of Messrs. De la Rue and Co., invented by Mr. E. Hill and Mr. W. de la Rue, seems, from its popularity, to claim our attention.

In this machine each piece of paper (previously cut by a fly press into the proper form for making an envelope, and having the emblematical stamp or wafer upon it) is laid by the attendant on a square or rectangular metal frame or box, formed with a short projecting piece at each corner, to serve as guides to the paper, and furnished with a moveable bottom, which rests on helical springs. A presser, at the end of a curved compound arm (which moves in a vertical plane) then descends and presses the paper down into the box,—the bottom thereof yielding to the pressure; and thereby the four ends or flaps of the piece of paper are caused to fly up: the presser may be said to consist of a rectangular metal frame, the ends of which are attached to the outer part of the curved arm, and the sides thereof to the inner portion of the arm; so that the ends and sides of the presser can move independently of each other. The ends of the presser then rise, leaving the two sides of it still holding down the paper; two little tappet pieces next fold over the two side flaps of the envelope; and immediately a horizontal arm advances, carrying a V-shaped piece charged with adhesive matter or cement (from a saturated endless band), and applies the same to the two flaps. A third tappet presses down the third flap of the envelope upon the two cemented flaps, and thereby causes it to adhere thereto; and then a pressing-piece, of the same size as the finished envelope, folds over the last flap and presses the whole flat. The final operation is to remove the envelope; and this is effected by a pair of metal fingers, with India-rubber ends, which descend upon the envelope, and, moving sideways,

draw the envelope off the bottom of the box (the pressing-piece having moved away and the bottom of the box risen to the level of the platform of the machine) on to a slowly moving endless band, which gradually carries the finished envelopes away. A fresh piece of paper is laid upon the box or frame, and the above operations are repeated.

The working of this ingenious machine appears to be one of the chief attractions of the Exhibition; but another, for the same object, invented by Mr. A. Remond, of Birmingham, and shewn in operation by Messrs. Waterlow & Sons, of London-wall, is equally deserving of attention. The distinguishing feature of this arrangement is the employment of atmospheric pressure to feed in the paper which is to form the envelope, and to deflect the flaps of the envelope into inclined positions, to facilitate the action of a plunger, which descends to complete the folding. The pieces of paper, cut to the proper form, are laid on a platform, which is furnished with a pin at each corner, to enter the notches in the pieces of paper, and retain them in the proper position; and such platform is caused alternately to rise and bring the upper piece of paper in contact with the instrument that feeds the folding part of the machine, and then to descend until a fresh piece is to be removed. The feeding instrument consists of a horizontal hollow arm, with two holes in the under side, and having a reciprocating movement. When it moves over the upper piece of paper on the platform, a partial vacuum is produced within it, by a suitable exhausting apparatus, and the paper is thereby caused to adhere to it at the two holes in its under surface by the pressure of the atmosphere. The instrument carries the paper over a rectangular recess or box; and then, the vacuum within it being destroyed, it deposits the paper between four pins, fixed at the angles of the box, and returns for another piece of paper. As the paper lies on the top of the box, the flap which will be undermost in the finished envelope is pressed by a small bar or presser on to the upper edge of two angular feeders, communicating with a reservoir of cement or adhesive matter, and thereby becomes coated with cement; and, at the same time, the outermost or seal-flap may be stamped with any required device, by dies, on the other side of the machine. A rectangular frame or plunger now descends and carries the paper down into the box; the plunger rises, leaving the flaps of the envelope standing upright; streams of air, issuing from a slot in each side of the box, then cause the

flaps to incline inwards; and the folding is completed by the plunger again descending;—the interior and under surface of such plunger being formed with projecting parts, suitable for causing the several flaps to fold in the proper order. The bottom of the box (which is hinged) opens, and discharges the envelope down a shoot on to a table below; the feeding instrument then brings forward another piece of paper; and a repetition of the above movements takes place.

A machine for a somewhat similar purpose to the above is exhibited by Mr. J. Black, of Edinburgh. The object of this machine is to fold printed sheets of paper, and it is proportioned to fold them to the octavo size; but machines may be made, on the same principle, to suit books or pamphlets of other sizes. To fold sheets for an octavo book three movements are requisite, viz., first to fold the sheet to half size; secondly, to double it at right angles; and, thirdly, to double it again at right angles to the last fold. In the machine these movements are effected by three blades or knives, which are formed with serrated edges, to prevent the paper slipping. The blades are affixed, at one end, to separate shafts or spindles, which simultaneously perform part of a revolution in either direction alternately, and so cause the outer end of each blade to describe an arc of about the fourth part of a circle; and as the actions of the knives are simultaneous, the machine contains three sheets, in different states of progression, at the same time. The sheet of paper is laid on a horizontal platform, in such a position that the first blade, in descending, will come across that part of the paper where the first fold is to be made,—draw the sheet through a slot or opening made in the platform, and carry it down into a narrow vertical passage or chamber: by which means it will be folded in half, and left in a vertical position. The second blade (which vibrates in a horizontal plane) then comes in contact with the central part of the doubled sheet, and folds it at that part, by drawing it into a narrow horizontal passage,—leaving such fold in a line at right angles to the vertical passage. The third blade (which vibrates in a vertical plane parallel to the first blade) draws the sheet down a vertical passage, so as to fold it again, and brings it to a pair of vertical delivering rollers, which pass it from the machine. Accuracy in laying the sheets upon the platform is insured by an arrangement consisting of a short adjustable straight-edge,

set parallel to the first blade, and of a projecting neb, set in the same parallel line. The attendant, who feeds the machine, takes hold of the sheet at the edge of the letter-press, and then lays it on the platform in such manner that his fingers come in contact with the straight-edge and neb,—whereby the central line of the sheet will be caused to lie exactly over the central slot in the platform: the position of the neb also indicates the point where the corner of the letter-press should be, in order that the subsequent folding in the opposite direction may be accurately performed. This is a very ingenious and efficient contrivance, and is well deserving the attention of bookbinders.

A self-acting machine for paging books and numbering documents is exhibited by Messrs. Waterlow and Son, and shewn in operation. As this class of machines has of late come into extensive use, owing to the protection which is afforded to the merchant and the tradesman by the consecutive paging of account and other manuscript books, it may be well to explain the general construction of the numbering apparatus and its mode of operation,—more especially as it forms an important adjunct to some machines which we shall hereafter have occasion to notice. The numbering apparatus consists of five discs, which are provided with raised figures on their periphery, running from 1, 2, 3, &c. to 0; and these figures serve (like letter-press type) to print the numbers required. The discs are mounted at the outer end of a vibrating frame or arm on a common shaft, to which the first or units disc is permanently fixed; and the other four discs (viz. those for marking tens, hundreds, thousands, and tens of thousands) are mounted loosely thereon, so that they need not, of necessity, move when the shaft is rotating; but they are severally caused to move in the following order:—The tens disc performs one-tenth of a revolution for every complete revolution of the units disc; the hundreds disc makes one-tenth of a revolution for every revolution of the tens disc; and so on. As the discs rise from the paper after every impression, the units disc is caused to perform one-tenth of a revolution (in order that the next number printed may be a unit greater than the preceding one), by a driving click taking into the teeth of a ratchet-wheel, fixed on the left hand end of the shaft. The movement of the other discs is effected, at intervals, by means of a spring-catch, affixed to the side of the units disc, and rotating therewith; which catch, each time that the units disc completes a re-

volution, is caused, by a projection on the inner surface of the vibrating frame, to project behind one of the raised figures on the tens disc, and carry it round one-tenth of a revolution on the next movement of the units disc taking place; and then, the catch having passed away from the projection, no further increase in the number imprinted by the tens disc will be effected until the units disc has performed another revolution. Every time that the tens disc completes a revolution, the spring-catch causes the hundreds disc to move forward one-tenth of a revolution; and similar movements are imparted to the remaining discs at suitable times. The shaft is prevented from moving, except when it is acted on by the driving click, by a spring detent or pall entering the notches in the periphery of a wheel fixed on the right-hand end of the shaft; and thus the discs are held steady while numbering, and a clear and even impression of the figures is insured. The leaves of the book to be paged or numbered are laid on a raised part of the table of the machine, covered with vulcanized India-rubber; and as each page is numbered, it is turned over by the attendant, so as to present a fresh page to the discs on their next descent. As the discs ascend after numbering each page, an inking apparatus (consisting of three rollers, mounted in a swing-frame, and revolving in contact with each other, so as to distribute the ink which is fed to the first roller evenly on to the third or inking-roller) descends, and inks the figures which are to be brought into action when the numbering apparatus next descends. By this means books or documents may be paged or marked with consecutive numbers. For printing duplicate sets of numbers, as for bankers' books, a simple and ingenious contrivance is adopted. This consists in the employment of an additional ratchet-wheel, which is acted on by the driving-click that moves the ratchet-wheel above mentioned, and is provided with a like number of teeth to that wheel. But the diameter of the additional ratchet-wheel is increased, to admit of the teeth being so formed that the driving-click will be thereby held back from contact with every alternate tooth of the first-mentioned ratchet-wheel; and thus the arrangement of the numbering discs will remain unchanged, to give, on their next descent, a duplicate impression of the number previously printed; but, on the re-ascending of the numbering apparatus, the click will act on a tooth of both ratchet-wheels, and move both forward one-tenth of a revolution; and, as the shaft ac-

companies the first ratchet-wheel in its movements, the number will consequently be changed.

Messrs. Schlesinger & Co. also exhibit a paging machine, the capabilities of which are similar to the above, but somewhat differently obtained. The numbering discs in this instance are provided with ten teeth, with a raised figure on the end of each tooth; and they receive the change motion from cog-wheels mounted below them on the same frame. At each descent of the frame a stationary spring-catch or hooked piece drives round the wheel one tooth, that gears into the teeth of the units disc, and thereby causes the units disc to bring forward a fresh figure. The toothed wheels are somewhat narrower than the numbering discs, but one tooth of each wheel is enlarged laterally to about double the size of the other teeth; so that at the completion of every revolution of the wheel the projecting tooth shall act upon a tooth of the next disc, and carry that disc forward one-tenth of a revolution. By this means the requisite movements of the discs for effecting the regular progression of the numbers are produced;—the first wheel driving its own disc and communicating motion at intervals to the next disc; and the other wheels each receiving motion at intervals from the disc with which it is connected, and transmitting motion, at still greater intervals of time, to the next disc.

The machine is caused to print the figures in duplicate by drawing the spring-catch out of action at every alternate descent of the frame, and thereby preventing any change of the figures taking place until after the next impression.

The numbers may be increased two units at each impression, so as to print all even or all odd numbers, by bringing a second catch into action, which causes the unit disc to advance one step during the ascending movement of the frame, in addition to the advance during the descent of the same.

This division of the Exhibition affords many ingenious and interesting examples of mechanism, applied to novel uses, which will be fully treated of hereafter.

DECORATIVE ART.

The degree of advancement attained in literature, and the practice of the fine arts, has been considered as indicative of the amount of civilization and refinement in people of every period in the history of the world; and, in some instances, in which written, and even traditionary, records of nations have long ago crumbled away, under the withering touch of Time, the monuments of their art still stand forth, the unimpeachable evidence of civilization and power. If this be true of the higher branches of art—of that dignified by the term fine art, *par excellence*—of art, the embodiments of which are found in the labors of the architect, the painter, and the sculptor, it is no less so of that modification of art in which it is presented to the senses, in connection with objects subservient to the ordinary wants of life. Some of the most indisputable proofs of the refined condition of ancient Greece are, perhaps, to be found in the perfection of those treasures of artistic skill which she has bequeathed to later times; but surely, it must be admitted, that an equally graphic, if less glorious, picture is to be obtained of the social state of the Egyptians of old, in the multitude of examples of their decoration, or art manufacture, which modern discovery has brought to light.

It is probable that, even in his lowest and most degraded state, an innate love of art, in the form of ornament, is inseparable from the mind of man: for the most abject savage carves rude figures upon his war club and spear, and decorates his person with the spoil from the brightest of the feathered race. This love of ornament is a natural attribute; and its gratification involves the exercise of one of the most strongly-developed of the mental faculties—that of imitation. From this circumstance it arises, that the earliest attempts at ornament consist in the rude imitation, either of brilliant colors, which possess a fascination for the eye, or of certain simple forms, rendered familiar from their constituting the defining limits of natural bodies; and it is interesting and remarkable to observe, in these crude attempts at ornamental art, how strong a natural abhorrence, even the uneducated eye, manifests for that which is harsh or ungraceful in form. The curvilinear system is that which seems to form the groundwork of all rude decoration; and it seldom happens that a certain amount of grace and harmony is not prevalent throughout.

The term ornament is one of vague signification—one,

the interpretation of which must be considered as totally relative, and dependent upon the design of the decorator. Fine art, in its ordinary sense—that is, as indicating painting, or sculpture, as abstract though practical sciences, existing *per se*, and complete in themselves—differs, in many essential particulars, from decorative art, or art applied to manufactures:—the painter may almost entirely create, or, at least, modify, to a very considerable degree, the conditions under which the resources of his art are made to display themselves. The material upon which he produces his designs, the media in which his colors are applied, even the character of the colors themselves, are all, more or less, within his control. He can modify them all according to his desire, or according to the nature and requirements of the subject upon which he is engaged. The sculptor likewise possesses, both in the clay and in the marble, materials, the capabilities of which are commensurate with the highest degree of artistic excellence. Not so with the art manufacturer: his means are limited, in more respects than one. In the production of that class of decoration which assimilates itself to painting, he is limited as to material, he is limited as to media, and he is limited as to colors; in that, again, in which form, or imitation of sculpture, is the object, he is often limited, in the most stringent manner, by the nature of the processes of his art, and in the difficulty of finding a material which can, under the necessary conditions, be employed for the interpretation of the artist's design. As to what is meant by the term ornament, that, as we have remarked above, depends entirely upon the nature of the object to be ornamented, and the material of which it is formed;—one great point to be observed (and this, we think, holds good in relation to every description of ornament, whether applied as mere decoration, or as constituting an essential element of a branch of manufacture) is appropriateness to its purpose; and this "fitness" may, doubtless, be the means of rendering highly proper, for an ornament, or as a portion of a design, an object which, viewed alone, may be considered as repulsive and disagreeable. A skull and the insignia of death can excite no pleasing ideas in the mind, and have no beauty of form or color to fascinate the eye; and they cannot therefore, under common circumstances, be regarded as ornamental; nevertheless, as a skull and bones constitute symbols of mortality, they are appropriate to the decoration of a tomb or mausoleum; and, by virtue of this fitness, may be looked upon in the light of an ornament. The great end of ornament is, however, to excite

pleasurable sensations in the mind; and, it seems to us, that there are three great elements of decoration and design;—these are, fitness to the intended purpose, harmony of forms, and harmony of color.

In the application of the art of design to manufactures, much of the ornament is purely conventional in its character, and is often the very reverse of excellent, both in respect to the form and combinations of color in the ornament itself, and to its appropriateness to the purpose for which it is employed. This conventionality of feeling with regard to decorative ornament, leads to that perpetual repetition of certain stock forms—if we may use such an expression—borrowed from the mediæval, renaissance, or some other particular epoch in the history of decorative art; and which, although possessing much merit in their original applications, are now destroyed in effect, by being dragged into situations to which they are in nowise suitable.

The true principles of the arts decorative, notwithstanding all that has been written and argued upon the subject, are just as difficult to define as the true principles of beauty. There is—there can be—but one broad universal principle,—that is, harmony of effect; the mere forms chosen by the artist to express his ideas, or the arrangement of colors must always be subservient to the great principle of harmony: this is the key, to which the whole of the elements of decoration, like notes in music, must be attuned; and if such be not the case, in decoration, as in music, discord must be the consequence. In England, the arts of design have not received—at least not until late years—that encouragement and fostering care necessary to their healthy development. We have tamely allowed ourselves to be surpassed by our continental neighbours in most branches of decoration; and it was not until about 14 years since, that any attempt was made on the part of the government to provide the requisite training for students of design. It is true that, previous to this period, private individuals had—as in the instance of the late Mr. Wedgwood—employed their whole energies in the advancement of certain branches of art manufacture; but it is not more than 14 or 15 years since that the importance of the arts of design became sufficiently recognized by the nation to obtain for them government protection and support. It is remarkable, that a country, deriving its whole wealth and importance in the scale of nations from its manufactures and industrial arts, particularly certain of the textile manufactures, should be so slow to per-

ceive the necessity of associating with their art manufacture, designs of a pure and elegant character. To add to this feeling of surprise, we must not forget that, in painting and sculpture, we have made rapid strides; that, as colorists, English painters stand unrivalled by any existing school; that the old reproach of bad drawing is overcome, or is at least in process of being so; and that English sculptors have produced works equal to any of modern times. The fault has been, that, previously to a late period, the art of design, applied to manufactures and decoration, was entirely separated from fine art;—that the professors of the latter looked upon design as an inferior kind of occupation; and the consequence was, that design, instead of being regarded as an essential and all-important element of art manufacture, came to be considered as a mere adjunct,—the execution of which was entrusted to the hand rather of the mechanic than of the skilled and regularly trained artist.

That the English people are naturally and constitutionally deficient in the capability of appreciating the beautiful, we totally deny: there is probably no country in which patronage of art is carried to a greater extent than in England; and the condition of the fine arts among us at the present moment is sufficient evidence of the amount of development of which English artistic skill is susceptible, under proper culture and encouragement. Unfortunately we are apt to refer most subjects to that searching commercial test "*cui bono;*" and as the profit and advantage are not always displayed upon the face of a beautiful and appropriate design or decoration, the manufacturer is, perhaps, somewhat too ready to turn to something less costly in its original production. That the neglect of good design in manufacture lies rather in want of taste in the manufacturer, or in want of skilled designers, to supply his requirements, than in want of taste and feeling among the public, is, we think, proved, in great measure, by the fact, that French textile manufactures, of a certain character—silks, ribands, and also paper-hangings, &c. —always bear away the preference in the English market. Indeed, to such an extent has this feeling gone, and such is the artificial state of the market excited by it, that it is a well-known practice, to designate as French goods, the superior fabrics (of the class mentioned above) of our own production. The establishment of government schools of design was, doubtless, a strong move in the right direction; for art applied to design and decoration, like other branches of art, requires education. It is only to be feared, that the school of design

has remained too much a school of drawing, and too little a school of art manufacture: at all events, the establishment of this Institution shews us that the importance of the subject has been recognized; and it has given an impulse to the subject in other quarters. Individuals have begun to exert themselves, although, in many respects, we fear, in a mistaken spirit. It is certain that, if art manufacture is to be the medium of raising up a general love of the beautiful in the minds of the people, it can only operate through the means of those objects which come frequently under their notice. Common objects of household use, without reference to material, are just as capable of receiving the impress of correct taste in form and ornament, as those of the most costly description; and, although exquisite art may be lavished on an inkstand, a jug, or a textile production,—if the cost of the article be such as to confine it entirely to the wealthy, it but poorly serves to disseminate a love of art among the masses of the people,—among those, indeed, whose tastes and habits serve, in great measure, to characterize a nation.

We, of 1851, should congratulate ourselves that we live in a time, and are witnesses of a gathering of art, in its most extended applications, which will do more to make its resources known to the world, and to excite a love of its beauties, than any circumstance, or even concatenation of circumstances, at one period, has ever previously done. It is fervently to be hoped that we shall avail ourselves, to the utmost, of this privilege; and that no national feeling, or prejudice, will be permitted to stand in the way of our imbibing instruction from the sources herein offered to us. Comparison—that most excellent test of advancement—is here afforded in its fullest sense; we can see what others have done in the paths of art, which we ourselves have been equally pursuing. We have the opportunity of remarking wherein they excel, or fall short, of our own work; and, if we have sufficient candour and good sense, we shall not fail to profit by what we see. As journalists, it will be our duty, in accordance with the task we have undertaken, and in continuation of our subject, to comment upon such of the different branches of art manufacture as seem to us most important,—taking, in illustration, objects contained in the Great Exhibition; and, in all we have to remark, we shall endeavour to preserve that moderate and advised tone of criticism which indicates the total absence of partizanship.

In our endeavour to make a practical application of the preceding remarks, we shall commence with that branch of

decoration and design employed in union with textile manufactures,—drawing our illustrations from the carpet manufacture, tapestry, and other materials of a similar character.

The carpet manufacture is a branch of industrial art which, although taking its origin from the remotest times, has been introduced into northern Europe at a comparatively late epoch. In eastern countries, carpets were known long ages ago, even in their different varieties; for we find that the ancients distinguished two kinds of carpet, according as the shag or facing was confined to one or both sides of the fabric,—the former being known under the name *tapetes*, the latter *amphi-tapetes*. A knowledge of the use of carpets was probably first obtained by the northern Europeans through the medium of the Crusades,—at all events, Persian and Turkey carpets came, at an early date, to be highly esteemed in Europe. Although carpets only came into general use in England at the end of the last century, they were introduced into France, and made the regular subject of manufacture in that country, at a much earlier period. About 1606 or 7, carpet making, by the Persian method, was brought into France, under the auspices of Henry IV., by a Frenchman, named Chaillot. These carpets are said to have been manufactured entirely of wool, and with a pile or face resembling that of velvet. The first carpet manufactured in England was made at Wilton, about 1750; and, in 1757, a Mr. Moore gained the premium offered by the Society of Arts for the best imitation of a Turkey carpet.

The carpet manufacture is one which has made rapid progress in England, and in visiting the Great Exhibition this fact is at once manifest; but the art of design applied to carpet-making, like that in other branches of art manufacture, remains in an unsatisfactory and undeveloped state. It is marvellous that with the extraordinary resources possessed by English manufacturers, in reference to the production of the mere fabric, so little regard has hitherto been given by them to that most essential element of a carpet—its design: but so it is;—the really appropriate style of pattern is a thing which is apparently only occasionally hit upon by chance, for, in nine cases out of ten, the designs employed are most unsuitable, both as to their decorative character and the arrangement of their color. The great and most general mistake among carpet designers is that of turning carpets into pictures: this is bad in two ways; firstly, it is irrational in principle to place a picture on the ground to be trodden upon; and, secondly, it is injudicious with regard

to effect, as small portions alone of a carpet—in the modern style of furnishing apartments—can be seen at the same time; and, consequently, where its beauty is derived from the relationship of one part to another, that beauty must be more or less destroyed. It appears to us that one great desideratum in a carpet design is the indication of flatness: in modern carpets, both English and Continental, there is generally a striving to produce rotundity and relief in the objects represented, be they fruits, flowers, or what not. This is entirely out of place. If we refer to the carpets of the East—the beauty and elegance of which have always been admitted—we find a totally different principle adopted. Instead of immense groups of magnificently-wrought and colored flowers, apparently standing up in high relief from the surface or groundwork of the carpet, we have a design in which the forms are made subservient to the general effect; in which, comparatively small patterns are merely made the vehicle of admirably-arranged colors,—the whole harmonizing perfectly; and no particular or individual element of the work standing forth obtrusively before the eye. In illustration of this, we should wish to direct the reader's attention to a Cashmere carpet, woven from silk, which hangs on the right-hand side of the Indian department of the Great Exhibition, on entering from the nave. It appears to us to unite in design all the chief points of excellency in a carpet; for instance, a small well-distributed pattern, the colors brilliant, and arranged in the most agreeable harmony. Some rugs at the entrance of the Turkey department also afford extremely good examples of the kind of design we have mentioned above; but, in these, although the harmony of color is good, the colors themselves are, in our judgment, inferior.

It is from the circumstance, that an unpleasant effect is produced by an appearance of strong relief in the design of a carpet, that geometrical or arabesque patterns are most suitable to this manufacture. In these, relief, except in slight degree, is in nowise necessary to the effect; they assimilate more in their character to the tesselated floors of the ancients, than which nothing can be more appropriate and beautiful. So far as our own taste goes, we believe that, under no circumstances, can any pictorial representation be "fit" for the decoration of a carpet;—conventionally, however, flowers disposed in groups and wreaths are considered as suitable; and into this feeling both continental and English manufacturers seem to have fallen. If we could divest our minds of the conviction of inappropriateness to their object, we should be

unable to withhold our admiration and praise from many specimens of highly-decorated carpets in the British department of the Exhibition. In some of these, the groupings of flowers constitute works of high artistic merit. An Axminster carpet, hanging against the extreme south gallery (manufactured for the Queen's drawing-room at Windsor by Messrs. Blackmore, after a design by L. Gruner), contains, in its centre, a beautiful group of flowers, both well drawn and colored, and, perhaps, equal, so far as the pictorial effect goes, to some of the best specimens of tapestry; but still the general effect is that of unsuitableness to its purpose.

There is another point which can scarcely fail to strike an intelligent observer, in connexion with the subject now before us. Even when, in certain respects, the design of a carpet is appropriate, and the colors skilfully arranged in one part—the centre, for instance—the effect of the whole is often spoiled by a totally unsuitable and inharmonious border.—There is evidently a want of artistic supervision—the whole seems to be in the condition of the traditionary portrait—made up from portions of various beautiful originals, but proving hideous in itself. This is perhaps too much to say of the branch of design we are now discussing; but there is certainly apparent, in most instances, a want of artistic feeling—in many its total absence.

With respect to the colors employed in modern carpets, the manufacturer has every advantage: the various dyeing processes have received so high a degree of improvement, that the tints of the wools almost equal in brilliancy and variety those of the palette of the painter; and we have only to examine many of the specimens of carpets now exhibited, to be convinced that there are few, if any, subjects which could not be rendered with facility through the instrumentality of the carpet-loom. This, then, is clearly not one of those branches of art-manufacture in which great obstacles are cast in the way of a ready interpretation of art, by the nature either of the material or of the process of manufacture: these are difficulties which have already been overcome. The material, that is, the textile fabric of our carpets, is unsurpassed, probably unequalled: our dye-houses furnish to the weaver an infinite variety of colors;—what, then, can be wanting to render complete the carpet manufacture in this country? nothing but the cultivation of a finer taste, the more liberal encouragement of the art of design, and the better education of the designers.

We would not be understood to be too sweeping in these

remarks: many specimens of carpets in the Exhibition have great merit, taking them altogether, and bearing in mind the peculiar general taste of the persons who purchase these products, and to which the manufacturer must in some degree bow. But we reiterate the opinion that the appropriate patterns for carpets are not pictorial subjects; and however beautiful these may be, as works of art, rendered in carpeting, they are not fitted to their intended employment—a covering for floors, to be trodden beneath the feet.

In reference to the arrangement of color in carpet designs we were struck with a few remarkable examples of complete ignorance or neglect of the laws of harmonious coloring evinced in these textile productions, and reminded how useful it would be to designers of colored textile or other decorative manufactures, to obtain some acquaintance with the phenomena of polarized light—for instance, with the development of that curious principle which shews us that certain colors always bear a fixed and beautifully harmonious relation the one to the other,—that they are always, what is termed, complementary; that is to say, by changing the conditions of the rays of light, which give the effect of color, one color will be invariably substituted by another, as red by green, blue by yellow, and so on,—the relationship between these different colors being unchangeable.

A good example of the geometrical pattern may be seen in a carpet manufactured by Kitely, of Kidderminster, designed for the New Palace at Westminster. This presents, likewise, an excellent arrangement of color. If flowers be admitted as an appropriate decoration, a carpet, hanging in the South Gallery, covered with a running wreath of roses, mixed with ivy leaves, must be considered good. No. 43, in the Netherlands, and 297 (a Tournay carpet), in the Belgian department, are also fine specimens of color; and, in many respects, of design as well.

From the carpet manufacture, we naturally pass to tapestry; but, upon this, we have but little to remark;—firstly, because the weaving of tapestry is an art which, at the present time, is not much cultivated in England; and, secondly, because, to the production of tapestry, the fine arts contribute much more considerably than mere design, or the arts decorative. The weaving of tapestry, when first introduced into England, was an art followed with great success; and English tapestry came to be considered equal, if not superior, to that of the Flemings, who were, probably, the earliest weavers of tapestry in Europe. By the gradual but almost universal substitu-

tion of paper-hangings, tapestry has, however, passed out of general use; and, as a branch of art manufacture, we believe it is nearly extinct in England. At the present time, the finest tapestry in the world is, probably, that of the Gobelins, in Paris, some exquisite specimens of which are shewn in the French department of the Great Exhibition.

In an essay upon decorative art, it may, perhaps, be somewhat out of place to notice these works, some of which may most properly be regarded as fine pictures; but it must be remembered, that the use of tapestry is the decoration of walls or panels; and, in this view, the subject is clearly connected with ornament and design.

The specimens of tapestry exhibited on the English side are not very successful; but those of the Gobelins afford the most admirable examples of the art. We particularly direct attention to two large groups of flowers with vases;—in these an extraordinary effect has been obtained, almost equal to the most felicitous efforts of the painter.

RECENT PATENTS.

To Jasper Wheeler Rogers, *of Dublin, civil engineer, for certain improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal.*—[Sealed 19th September, 1850.]

It is well known, that, in the manufacture of peat, considerable loss arises from the upper surface, or more porous part of the bog, being obliged to be removed and thrown aside, so as to get at the more dense strata underneath. It is also well known, that, in bringing the peat to a nominally dry state, considerable loss is sustained from the friability of the sods or pieces;—as large quantities of peat-mould, or, technically speaking, "mull," accumulate, which are useless, or of little value. Now, the object of the present invention is,—first, to obviate these evils, and convert this accumulating refuse into a valuable product; and, secondly, to render more perfect and effectual the system of charring or carbonizing peat, described in the specification of a patent granted to Mr. Rogers, June 1st, 1848.*

The following are the means whereby it is proposed to

* For description of this invention see Vol. XXXIV. of our present Series, p. 145

utilize the "upper surface" of the bog, and the peat-mould or mull, and produce fuel or charcoal therefrom:—When the upper surface is being removed, it is placed in pyramidal or other shaped heaps, in any convenient place, where the rain will not lodge, and where the moisture may run away. After being left to dry for as long a time as can be conveniently permitted, it is removed to the drying house or building (particularly described in the specification of the former patent), where it is intermixed with the dry mull or mould which accumulates from the friability of the peat. This intermixture is effected by hand-labor, or by machinery constructed upon the same principle as the "pug-mill;"—the material having been previously screened, to keep back all pieces exceeding a cubic half inch in bulk. When this mixing has been properly effected, the material is subjected to the action of heat, in the apparatus shewn in Plate XVI.: which apparatus is set up in a shed, similar to those described under the former patent. Fig. 1, is a longitudinal section of the apparatus; and fig. 2, is a cross section of the same. The material to be operated upon is placed in a hopper or chamber *a*, situate at one end of a chamber or trough *b, b*, which extends from one end to the other of the shed, and is supplied with the mixed material from the hopper *a*. In this trough, a screw *c, c, c*, revolves, for the purpose of propelling the material forward as it falls from the hopper. The trough *b*,—which is termed the charring and carbonizing chamber—is suspended to or secured within the air-chamber (shewn in the drawing, and described in the former specification), and over the furnaces in which the charring of the peat takes place:—the caloric or heat collected within this air-chamber is very considerable. *d, d*, is a double furnace, opening at each side of the air-chamber, and extending through it, at the end furthest from the hopper; and *e, e*, is a flue, running from thence and terminating in the funnel *f*, which communicates with the main funnel *g*. In the furnace *d*, is placed the peat, which is now required to be brought to a red heat, in order to ignite the peat contained in the pyramidal furnaces *h, h, h*. At present all the gases given off from the peat, thus used, are lost; as the ignition takes place in heaps prepared solely for that purpose. By this new method, all the caloric yielded up, until the fuel is brought to the required state, is applied to heat the trough *b, b, b*, and thereby effect the charring or carbonization of the material contained therein. This operation is further assisted by the heat given out from the furnaces *h, h, h*. The peat is left in the furnace *d*, until all its

flame is given off; and it is then discharged from either side of the furnace alternately (when wanted to ignite the peat in the furnaces *h, h,*) by letting down the fire-bars (as shewn by dots in the drawing), and allowing the red-hot peat to drop into a barrow, which is then covered and wheeled away. By this discharge of the ignited peat from either side of the furnace, alternately, a continuous heat is kept up, which will greatly assist in effecting the charring or carbonizing of the peat in the trough or chamber *b*. One end of the shaft of the screw *c*, carries a cog-wheel *i*, which is driven by any convenient motive power, and thereby causes the screw to rotate, and propel forward the intermixed mull and upper surface, which falls from the hopper *a*, into the trough *b*. By this means, every particle is being constantly turned and acted upon by the heat; and the result is, that the material, after passing along about two-thirds or three-fourths of the length of the trough, loses all its moisture, and, in completing its passage to the end of the trough, becomes thoroughly charred or carbonized. It is to be observed, that from two-thirds to three-fourths of the trough, where the drying takes place, is open at top; but the remainder, where carbonization is effected, is closed.

Hitherto it has been found a matter of some difficulty, after the completion of the charring or carbonizing operation, to cool the incandescent mass, and prevent the rapid oxidation and consequent waste of the charcoal when exposed to the air in a red hot state. The manner in which the patentee proposes to effect this object is as follows:—Near the carbonizing end of the chamber or trough *b*, a cylinder *k*, is provided: this cylinder is mounted on hollow gudgeons, and is caused to rotate by means of the shaft and pinion *l*, and *m*, in connection with any first mover. The lower side of the cylinder *k*, rests in a trough of water, supplied from the perforated pipe *n*, which produces a constant sprinkling of water over the whole cylinder. Inside the cylinder, and attached to the periphery thereof, is a screw-thread, of the same pitch as the screw in the carbonizing chamber: the same speed of rotation is given to both these screws. The charred or carbonized peat, having passed up an incline, formed by a hollow cone, attached to the end of the chamber *b*, and projecting into the hollow gudgeon of the cylinder *k*, delivers itself into the cooling cylinder, where it is turned over and propelled forward by the rotating thread on the inner periphery thereof; and thus every particle is, in its turn, brought into contact with the cooling surface of the cylinder, and the caloric which it

contained is quickly abstracted. The charcoal, thus reduced to the ordinary temperature, is now, by the continued rotation of the cylinder, delivered at the opposite end to that at which it entered; and, after ascending an incline, and passing through the hollow gudgeon, it falls into a receptacle, placed to receive it. The object of making the ends of this cylinder conical, is to allow of its immersion in water, without the water being able to enter the interior through the ends.

Fig. 3, shews a modification of the above-described arrangement for charring or carbonizing, and afterwards cooling, the peat refuse. *o, o,* is a conical chamber (the axis of which is horizontal), communicating with a hopper *p,* and forming a channel with a downward and upward incline, by the base or larger diameter of the cone being the discharging end. The peat refuse to be dried passes downwards freely along the channel, and, in its passage, is acted upon by the heated surface thereof; whilst the moisture that is driven off traverses upwards without check along the upper incline, and passes out at the funnel *q*. At *r*, the discharge of the peat in a dry state takes place; and when made up into blocks, it may be used as ordinary fuel for general heating purposes. But when the peat is desired to be converted into charcoal, it is conducted from the drying chamber into the charring or carbonizing chamber, which is provided with a rotating-screw, as before explained, for turning over the peat, and submitting every part to the action of the heating surface; and when the carbonization is effected, the incandescent charcoal is delivered from thence into the cooling chamber, as before described.

The patentee observes, that the length and diameter of the screws and cylinders will vary, according to the quantity of charcoal required to be produced, and the nature of the mould, mull, or upper surface, to be acted upon.

In the specification of the patent before mentioned, the patentee described a mode of charring peat, by piling it up in pyramidal furnaces, from which the air is to be excluded at a certain period of the process; but, as a more perfect exclusion of atmospheric air than has yet been attained is essential to the economical and abundant production of charcoal from peat, he has invented the following means for effecting this object:—It will be seen, on referring to the drawings, that the pyramidal furnaces are placed under an air-chamber, according to the patent of 1848; but, instead of an ash-pit being made from end to end of the shed, with doors to close and exclude the air from the burning mass of peat in the furnaces (which plan in practice has been found to require greater

nicety of workmanship than is desirable), a shallow tank is formed, which extends from end to end of the shed, to receive the pyramidal furnaces containing the peat to be operated upon; and these furnaces, which are mounted on wheels, are run into and out of the tank over inclined planes, at either end thereof, as shewn in the sectional elevation, fig. 1. The furnaces being placed in this tank, the process of burning takes place; and, as soon as the masses of peat within the furnaces are brought to a red heat throughout, water is admitted by a pipe, prepared for the purpose, into the tank, and, rising to the height shewn by the dotted line, or about an inch or two above the bottom edge of the furnace sides, the passage of the air between the fire-bars will be immediately cut off. The furnaces are then closed at top, according to the mode stated in the specification of the patent of 1848; and the charring operation is completed in the space of four, five, or six hours.

The patentee claims, as his invention of improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal, First,—the means, hereinbefore described, for treating the general refuse of bogs, and the dust and mould, or mull, of peat, so as to convert it into fuel or charcoal; and, Secondly,—the mode of excluding the atmospheric air from the charring or carbonizing furnaces, as above described.—[*Inrolled March,* 1851.]

To Benjamin Cheverton, *of Camden-street, Camden-town, in the county of Middlesex, artist, for methods of imitating ivory and bone.*—[Sealed 19th, June, 1850.]

This invention consists in treating alabaster, gypsum, or other variety of native sulphate of lime, of which water is a constituent, in such manner as to cause the same to resemble ivory and bone, both in the natural state and when dyed or stained.

In carrying out the invention, the patentee produces the articles—which are intended to present an appearance similar to ivory or bone—by one of the two following methods:—He cuts the article to the desired form out of a block of alabaster, gypsum, or other variety of native sulphate of lime; or else he reduces the sulphate of lime to the state of plaster of Paris, and produces the article by compressing the powder in moulds: the patentee states, at the conclusion of his specification, that the first method is most suitable for the manufacture of imitation ivory, and the second method for imitation bone.

The articles are first placed upon trays in an iron oven, and kept therein for forty-eight hours; during which time the temperature is gradually increased from 250° to 350° Fahr.: by this process the water is driven off, and the articles become opaque, hard, and brittle. The articles are next exposed to the action of the atmosphere for three or four hours, and then immersed in white hard varnish, or ordinary olive oil, or other oleaginous, fatty, or waxy matter, in a liquid or melted state, until their surfaces become saturated therewith: the articles are thereby caused to have the transparency of ivory or bone, and to possess greater brilliancy of color when dyed. After this, they are immersed for an instant in water, kept heated to from 100° to 150° Fahr.;—the immersion is repeated every fifteen minutes until the articles become saturated; and after such saturation, they are allowed to remain immersed in the water until they have acquired the desired degree of hardness: the time requisite to effect this will depend upon the size of the articles;—for small articles, two hours will be sufficient; and for large articles, the time of immersion may even extend to ten hours. If the articles are required to be dyed or stained, so as to present the appearance of dyed ivory or bone, they are immersed in heated dye-liquor instead of pure water. The articles, after being treated in the manner above described, may be polished with whiting or putty-powder in a lathe.

The patentee does not claim the use of heat to evaporate the water in combination with alabaster, gypsum, or other variety of native sulphate of lime, of which water is a constituent,—or the use of water or dye to harden or color it after such evaporation; but he claims the use of varnish, commonly called white hard varnish, or of ordinary olive oil, or of other oleaginous, fatty, or waxy matter, in a liquid or in a melted state, in conjunction with the two other stages of his process, whereby translucency and transparency are obtained.—[*Inrolled December*, 1850.]

To ALFRED VINCENT NEWTON, *of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in dyeing yarn, and in manufacturing certain woven fabrics,—being a foreign communication.*—[Sealed 26th September, 1850.]

THE first part of this invention consists in weaving two and three-ply ingrain carpets, by the combination of party-colored

warp and weft, arranged so as to cause the warp and weft to unite in forming the same color in the figure, produced by the Jacquard or any other mechanical means; whereby any variety of colors or shades, on one or more plies, that may be desired, may be produced in the same range, in the direction both of the warp and weft,—the figure being formed by throwing down the weft, which obviates any difficulties arising from imperfections in the party-coloring of the yarn.

The mode of procedure which the inventor has practised is as follows:—For a two-ply carpet, the warps are party-colored according to the figure to be produced, and the variety of its colors. If, for instance, it is desired to have, in the same range, red, green, and blue, the warps have a portion red, of such length that, when woven in, the red will appear on the surface,—then a portion green, of the required length,—and then a portion blue. Each warp-thread must be party-colored according to its position in the breadth of the fabric; and if it be desired also to vary the colors of the fabric in the direction of the breadth, it will be obvious this may be done in like manner; as the form of the figure and the variety of its colors, in connection with the length taken up by the weaving-in, will determine the length and variety of colors to be given to each warp-thread. But this alone would not suffice; for the weft would still present a striped appearance on the fabric; and to avoid this the inventor also party-colors the weft to correspond with its position in the fabric,—making the requisite allowance for the slight amount of length which will be taken up by the weaving-in or interlacing of the warps; so that, with this allowance, the position of each weft in the figures will determine the variety of colors, and the length of each, which is to be given to the weft-threads in party-coloring them. In this way one surface of the two-ply will present the full and well-defined figure of any variety of colors or shades desired; but the other, or under face, will not be so perfect; as by the working of the Jacquard the various colors will be carried through to the under ply. Still greater variety may be given to the figure by party-coloring the ground warp and weft.

In the weaving of three-ply carpets, the warp and weft are to be prepared and treated in the same manner as for the two-ply; but, having one more ply, a greater variety can be obtained by party-coloring the yarns for two or all of the plies, if desired.

The figure is not produced by party-coloring the yarn, but

by the Jacquard; and the yarn is party-colored simply to prevent the blending of colors which are not desired, and which really do not belong to the design; so that in a given length there may be any desired variety of colors; whereas, in the usual mode of weaving such fabrics, the figures in the same range can only be of one color.

The inventor is aware that fabrics have been woven with party-colored warp, and sometimes with party-colored weft; but he is not aware that two or three-ply ingrain carpets, or any other fabrics, have ever been woven with party-colored warp and weft combined, for the purpose of causing the same color in both to unite in forming the same color in the fabric. What is claimed, therefore, in the weaving of two or three-ply ingrain carpets, is the employment of party-colored warp and weft—operated by the Jacquard or other mechanical means to form the figure—when the same colors in the warp and in the weft are caused to combine together, to form the same colored figure in the fabric, substantially as described.

The second part of the invention refers to the operation of dyeing yarn. It is well known that yarns have heretofore been party-colored by printing, and by dipping skeins into a vat of dye-liquor, with the parts which were not to be dyed tied up or wrapped around to prevent the access of the dye-liquor. But, as heretofore practised, these methods have been attended with serious practical difficulties;—the former plan not admitting of giving permanent colors, besides requiring complex machinery, the working of which demands much skill and attention; and the latter having been unsuccessful, for the reason that the means employed for preventing the access of the dye-liquor to the parts not to be dyed, would not effectually exclude the coloring matter.

In the method which forms the second head of this invention, the yarns to be party-colored are rolled around two rollers or reels, either fluted or made of wire, and placed one at each end of a frame,—the journals of either one or both of the said reels working in slides connected with the frame. One or any number of these reel-frames is then suspended in a vertically-sliding-frame, moved by suitable machinery, by means of which the reels, with the yarns on them, can be let down into a vat containing the dyeing or coloring liquor;—the depth of immersion being indicated by a scale, either marked on or attached to the frame of the reels. After the required immersion, the reel-frames are removed, and either reversed, to immerse the other end, or the reels are turned, to

bring another part of the yarns in the proper position (depending on the pattern to be produced), and then again dipped in the same or another color. After the yarn has been immersed, the immersed reel is drawn up by the slide, so that the cords or flutes of the reel may not be in contact with the yarn: which contact would have the effect of preventing the free access of the dye-liquor to the entire surface of the yarn, and thus leave an imperfect color.

In Plate XVI., fig. 1, shews a longitudinal vertical section of the apparatus employed for the party-color dyeing of yarn; fig. 2, is a sectional plan of the same, taken in the line * *, of fig. 1: fig. 3, is a cross section of the apparatus; and fig. 4, is an end view of the reel-frame. *a*, represents a vat, to contain the dyeing liquor; *b, b, b, b*, are four vertical posts, one at each corner, grooved out vertically, as at *c*, to receive four sliding-racks *d, d, d, d*. Gearing into these racks are four pinions *e, e, e, e*, two on each of two horizontal shafts *f, f*, one at each end of the vat; and these two shafts are connected together, so as to move in unison, by two bevilled cog-wheels *g, g*, on their ends, which engage two similar wheels *h, h*, on a horizontal shaft *i*,—which shaft is provided at one end with a crank-handle *j*, whereby the sliding-racks can be elevated or depressed, and with a ratchet-wheel *k*, and catch *l*, for holding them in any position desired. The four sliding-racks carry a horizontal frame *m*, in which may be suspended any desired number of reel-frames, similar to the one *n*, shewn in the drawings. This reel-frame is composed of two side pieces *o, o*, connected by cross bars *p, p*, which project sufficiently beyond the side pieces to rest on the frame *m*. The ends of the side pieces are slotted, (as at *q*,) to receive and admit of the sliding in and out of the journals of two reels *r, r*; which reels are either fluted rollers, or made with wire rods attached to two heads on a shaft. The journals of these reels are fitted to turn in plates or slides *s, s*, at the sides of the reel-frame, and are provided with catch-teeth, so that they can be held in any desired position by catching on to pins in the sides of the reel-frame. The yarn to be party-colored is wound, by any means desired, around the two reels, as represented at *t*, figs. 1, and 3; and then the reel-frame is suspended in the horizontal frame *m*, as shewn in those figures. As many of such reel-frames as the frame *m*, will carry, can be in like manner suspended. A scale is then attached to one of the reel-frames; and, by turning the crank-handle, the whole is let down into the dye-liquor to the depth desired, as indicated by the scale,—depending on the

figure to be produced in the weaving of the fabric. The lower reel is then drawn up by means of the sliding-plates *s*, *s*, so as to give the liquor free access to the whole surface of the immersed yarn. After the proper period of immersion, the whole is drawn out of the liquor; the lower reel is pushed down again, to tighten the yarns; and then the reel-frames are removed, to rinse out the surplus coloring matter. If the figure to be produced and the distance of the two reels apart admit of it, the reel-frames may be inverted, and dipped into the liquor in like manner (or the yarn may be dipped into any other color); but otherwise the reels are to be turned, to bring other parts of the yarn in a proper position to be immersed in the same or another color. In this way, yarns can be party-colored in any manner desired, either for the warp or weft, for the weaving of figured fabrics.

It will be obvious, from the foregoing, that, although but one particular construction of apparatus for bringing round the yarn, and retaining it in a proper position to be submitted to the action of the dye-liquor, is shewn, yet the apparatus may be varied greatly within the range of the principle of this invention. The patentee does not, therefore, intend to confine himself to the special mode of construction or arrangement herein specified; but retains to himself the privilege of varying the apparatus at pleasure, so long as he attains the same end by equivalent means. What he claims, as the second part of this invention, is the method (substantially as herein described) of party-coloring or dyeing yarn, by the use of reels (or other analogous parts for holding the yarn), arranged in frames, so constructed as to admit of immersing in dye-liquor such portions of the hanks of yarn as are desired to be dyed, substantially as described. And he also claims connecting one or both of the reels in each frame by means of slides, to admit of removing the lower reel from contact with that part of the yarn which is immersed in the dye-liquor.—[*Inrolled March*, 1851.]

To Clement Augustus Kurtz, *of Manchester, in the county of Lancaster, practical chemist, for improvements in dyeing,—being a communication.*—[Sealed 19th November, 1850.]

This invention relates to the dyeing of skeins or hanks of silk, cotton, worsted, or other fibrous material, in such manner that the same will be party-colored, or certain portions

thereof will retain the original color while the other parts are dyed of a different color. This effect is commonly produced either by printing with blocks or machinery, or by binding cloth, calico, bladder, or other substance, around the skeins or hanks with string, or binding cord only around them, previous to immersing them in the dye-bath. The skeins or hanks remain immersed in the bath until the uncovered parts thereof become sufficiently dyed; they are then taken out and dried; and, on the coverings being removed, the skein or hank presents a party-colored appearance.

In the party-colored skeins or hanks, produced by the above means, the parts where the different colors meet are strongly defined by the pressure of the cord, &c. Now, it has been found desirable to obtain party-colored skeins or hanks with the edges of the colors blending together and gradually fading into each other. This the patentee effects by tyeing slip-knots in the skeins or hanks at those parts which are not to receive the color when the same are immersed in the dye-bath. Thus, supposing the operator to have in his hand a skein of white or undyed silk, which it is desired to dye, at certain parts, of a green color,—he ties the skein into slip-knots at the parts which are to remain white, and immerses the skein in the dye-bath; and when it has remained therein a sufficient time, he takes it out, and washes and dries it: on pulling out the ends of the skein, so as to untie the slip-knots, it will present a party-colored appearance; and as the green color penetrates partially into the slip-knots, the edges of such colored portions will be irregular and gradually fade into the white parts. By a like operation, skeins or hanks which have been previously dyed may be rendered party-colored. When skeins or hanks are required to be dyed with three or four different colors, such as yellow, red, and blue, the skeins are first dyed of a yellow color; they are then tied in slip-knots at those parts which are to remain yellow, and immersed in a bath of red dye; they are taken out of this bath, washed, and dried; then, without untying the slip-knots just mentioned, the skeins are again tied in slip-knots at those parts which are to be left red, and put into a bath of blue dye; when removed from this bath, they are again washed and dried; and, on the slip-knots being untied, by pulling the ends of the skeins, the skeins will be found to have been dyed with three colors—yellow, red, and blue—at different parts thereof.

The patentee states, that he does not claim the dyeing of silk, cotton, worsted, or other material, in the hank or skein,

in party-color,—as such operation has been previously performed as above mentioned, and otherwise; but he claims the mode (above set forth and described) of dyeing skeins or hanks of silk, or other suitable material, so as to produce irregular edges of various intermediate shades.—[*Inrolled May*, 1851.]

To JOHN MERCER, *of Oakenshaw within Clayton-le-Moors, Lancashire, Gent., for improvements in the preparation of cotton and other fabrics and fibrous materials.*—[Sealed 24th October, 1850.]

THIS invention consists in subjecting cotton, flax, and other vegetable fibrous material, and fabrics made therefrom, either alone or mixed with silk, wool, or other animal fibrous material, to the action of caustic soda or caustic potash, or dilute sulphuric acid, or a solution of chloride of zinc, of such strength and at such a temperature as will produce the effects hereafter mentioned.

The mode of operating, according to this invention, upon cloth made wholly or partially of any vegetable fibres, and bleached, is as follows:—The cloth is passed through a padding machine, charged with caustic soda or caustic potash at 60° or 70° of Twaddle's hydrometer, at the common temperature of the atmosphere (say 60° Fahr., or under); then, without being dried, it is washed in water; and, after this, it is passed through dilute sulphuric acid, and washed again. Or the cloth is conducted over and under a series of rollers in a cistern containing caustic soda or caustic potash at 40° to 50° Twaddle, at the ordinary temperature (the last two rollers being set so as to squeeze the excess of soda or potash back into the cistern); and then it is passed over and under rollers placed in a series of cisterns, which are charged at the commencement of the operation with water only; so that when the cloth arrives at the last cistern, nearly all the alkali has been washed out of it. After the cloth has either gone through the padding machine or through the cisterns, it is washed in water, passed through dilute sulphuric acid, and again washed in water.

When grey or unbleached cloth, made from the abovementioned fibrous material, is to be treated, it is first boiled or steeped in water, so as to wet it thoroughly; then most of the water is removed by the squeezers or hydro-extractor; and, after this, it is passed through the soda or potash solution, &c., as before described.

Warps, either bleached or unbleached, are treated in the same manner; but, after passing through the cistern containing the alkali, they are passed through squeezers or through a hole in a metal plate, to remove the alkali; and then the warps are conducted through the water cisterns, "soured," and washed, as above described.

When thread or hank yarn is to be operated upon, the threads or yarns are immersed in the alkali and then wrung out (as is usually done in sizing or dyeing them); and afterwards they are subjected to the above-mentioned operations of washing, souring, and washing in water.

When any fibre in the raw state, or before it is manufactured, is to be treated, it is first boiled in water, and then freed from most of the water by the hydro-extractor or a press; after which, it is immersed in the alkaline solution, and the excess of alkali is removed by the hydro-extractor or a press; then it is washed in water, soured with dilute sulphuric acid, and washed again; and finally the water is removed by the hydro-extractor or a press.

The following are the effects produced by the above operations upon cloth made of vegetable fibrous material, either alone or mixed with animal fibrous material:—The cloth will have shrunk in length and breadth, or have become less in its external dimensions, but thicker and closer; so that by the chemical action of caustic soda or caustic potash on cotton and other vegetable fabrics, an effect will be produced somewhat analogous to that which is produced on woollen by the process of fulling or milling. The cloth will likewise have acquired greater strength and firmness,—greater force being required to break each fibre. It will be found to have become heavier than it was previously to being acted upon by the alkali; if in both cases it be weighed at the temperature of 60° Fahr., or under. It will also have acquired greatly augmented and improved powers of receiving colors in printing and dyeing.

The effects resulting from the above treatment of the vegetable fibre, in any of its various stages, before it is made into cloth, will be readily understood from the statement of the effects produced on cloth, composed of such fibre, by treating it according to this invention.

Secondly, the patentee employs diluted sulphuric acid, at 105° Twaddle, and at 60° Fahr., or under, instead of caustic soda or caustic potash,—the operation being the same as when soda or potash is used, except the last souring, which is now unnecessary.

Thirdly, the patentee uses a solution of chloride of zinc, at 145° Twaddle, and from 150° to 160° Fahr., instead of the soda or potash, and in the same manner.

When operating on mixed fabrics, composed partly of vegetable fibres and partly of silk, wool, or other animal fibres, such as delaines, it is preferred that the strength of the alkali should not exceed 40° Twaddle, nor the temperature be above 50° Fahr., lest the animal fibres should be injured.

The apparatus and the temperature and strength of the soda or potash, sulphuric acid, or chloride of zinc solution, may be varied to a considerable extent, and will produce proportionate effects: for instance, the soda or potash may be used at a strength even as low as 20° Twaddle, and still give improved properties to cotton, &c., for receiving colors in printing and dyeing, particularly if the temperature be low; for the lower the temperature, the more effectually the soda or potash acts on the fibrous material. The patentee does not, therefore, confine himself to any particular strength or temperature; but he prefers the strength, heat, and process above described.

He claims, as his invention, the subjecting of cotton, linen, and other vegetable fibrous material, either in the fibre or any stage of its manufacture, either alone or mixed with silk, woollen, or other animal fibrous material, to the action of caustic soda or caustic potash, dilute sulphuric acid, or solution of chloride of zinc, of a temperature and strength sufficient to produce the new effects and give to them the new properties above described, either by padding, printing, or steeping, immersion, or any other mode of application.—[*Inrolled April*, 1851.]

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

April 29*th*, 1851.

WILLIAM CUBITT, Esq., President,—in the Chair.

Previous to the ordinary meeting, Mr. Joseph Whitworth, of Manchester, exhibited, in the library, a new measuring machine, for determining minute differences of length. The accuracy of the machine was demonstrated by placing in it a standard yard measure, made of a bar of steel, about three quarters of an inch square, having both the ends rendered perfectly true. One end of the bar was then placed in contact with one face of the machine, and, at the other end, between it and the other face of the machine,

was interposed a small flat piece of steel, termed, by the experimenter, "the contact piece," whose sides were also rendered perfectly true and parallel. Each division on the micrometer represented the one-millionth part of an inch; and each time the micrometer was moved only one division forward, the experimenter raised the contact piece, allowing it to descend across the end of the bar by its own gravity only. This was repeated until the closer approximation of the surfaces prevented the contact piece from descending—when the measure was completed, and the number on the micrometer represented the dead length of the standard bar, to the one-millionth part of an inch.

Eight repetitions of the experiment, in a quarter of an hour, produced identical results,—there not being, in any case, a variation of one-millionth of an inch.

This method of operating was termed "the system of proof by the contact of perfectly true surfaces and gravity;" and, in connexion with it, was shewn another interesting experiment.

When the micrometer was up within one division of the number where contact would be presumed to occur, the application of the finger to the centre of the steel bar sufficed to expand and lengthen it instantaneously, so as to prevent the descent of the contact piece.

The other method of proof was, by having a small simple battery, composed of a piece of zinc, soldered on to a piece of copper, and plunged into rain water, without the admixture of any acid; and this was connected with the two ends of the measuring machine, and also with a delicate galvanometer. On pursuing the same process of advancing the micrometer, one division at a time, no effect was produced, until the last millionth of an inch of distance was traversed, and absolute contact occurred with the end of the bar—when the deflexion of the needle of the galvanometer instantly detected the movement. Repeated experiments shewed this to be unerring in the result; and on placing the finger on the middle of the bar, under the same circumstances as in the other course of experiments, the expansion was instantly detected by the deflexion of the galvanometer needle.

The paper read was,—*On the demonstration of the rotation of the earth, by means of two pendulums.* By Mr. H. Cox, B.A.

The demonstration of the rotation of the earth was usually made to depend on phenomena presented by the appearance of the heavens. Two mechanical experiments had, however, long been known, which demonstrated the fact, that the earth revolved: the one, the retardation of the pendulum by centrifugal force,—a question discussed by Newton, Huygens, and others; and the other, which was suggested by Newton, consisted in dropping, from a great height, a ball, which, by the diurnal motion, was moved somewhat to the eastward.

The experiment had hitherto been performed with one pendulum; but, in the present instance, two pendulums were used, and were suspended at a sufficient distance apart to allow of the free vibration of each. The weights were held together by a thread, which, on being burned, released them, so that they were set vibrating, initially, in the same vertical plane: consequently, to the eye of an observer, situated in that plane, the two pendulum wires appeared coincident,—one of them covering or eclipsing the other. In a short time, however, the course of the two pendulums visibly altered. As their planes of oscillation appeared to revolve the same way on the earth's surface, the wires no longer covered each other, but appeared to separate, and alternately to cross each other.

The advantages of this mode of operating were, first, the rapidity with which the deviation of the pendulums was manifested,—for, as their planes revolved in the same apparent direction, their arcs diverged from each other twice as fast as either did from its initial position; and, secondly, the apparent crossing and re-crossing of the wires, constituted, to the naked eye, a much more distinct and palpable test of the result than the apparent motion referred to a plane beneath one pendulum.

May 6th, 1851.

The first paper read was,—*On a mode of computation for excluding floodwater from a set of gaugings of a stream, taken at regular intervals.* By Mr. James Leslie, M. Inst. C. E.

In this method, the gaugings were all set down in a table, in the order of their quantities, and then the whole number of observations was divided into four equal parts,—of these the lowest fourth was considered to include the extreme droughts, and the highest fourth the floods. The average of the two other parts was then taken, and a new table constructed, in which all the gaugings not exceeding that average were put down at their actual quantity; but all those above the average were put down as equal to it: by which means the excess caused by floods was excluded, and the average of the whole of this new table afforded a fair average of the quantity of water flowing in a stream.

The second paper was entitled,—*Results of a series of practical experiments on the discharge of water by overfalls or weirs.* By Mr. T. E. Blackwell, M. Inst. C. E.

In this paper the author gave, first, the results of a series of experiments, undertaken for the purpose of determining, by actual measurement, the quantities of water discharged by overfalls, or weirs, of different dimensions, and under different circumstances;—and, secondly, calculations to shew how far the formulæ in

general use indicated correctly the law followed by such discharges. This had been felt to be the more desirable, on account of the comparatively small dimensions of the overfalls used in the experiments from which the rules hitherto established had been deduced; and the apparatus erected for the purpose of the experiments, described in the paper, was constructed so as to allow of experiments over weirs of 3 feet, 6 feet, and 10 feet wide respectively, and with heads of water from 1 inch up to 14 inches in depth. The forms of the overfall bars were varied, being severally a thin iron plate—a plank 2 inches thick, which might be supposed to represent the ordinary wasteboard,—and a timber crest, of 3 feet in breadth, which represented a broad dam, such as formed the weir of a river. These broad crests were also placed alternately level, and were made to slope 1 in 12, and 1 in 18.

The results shewed, that as the widths of the overfalls, and the depths of water passing over them, varied, so the amount of opposing forces—such as the contraction of the fluid vein, friction, and opposing currents—also varied; and this being the case, the co-efficients employed in the rules for reducing the theoretical to the actual discharges, should vary also,—no one co-efficient, or per centage of allowance, on account of these opposing forces, being found applicable to all circumstances.

The more prominent deductions which were made, were, that in overfalls, generally, the thinner the edge or crest over which the water passed, the greater would be the quantity discharged;—that the allowance required on account of contraction, &c., was generally less, as the head became greater, up to about the head of 9 inches, when it seemed to follow a different law, and the effect of these hindrances was more powerfully felt;—that the discharge by overfalls was very much increased by facilitating the approach of the water to them by convergent wings;—and, lastly, that the effect of increasing the breadth of the crest of the weir was to diminish, very considerably, the discharge, especially when it was level, or had only a slight inclination.

The tables appended to the paper gave the results of two hundred and fifty experiments, made on an overfall, placed on a perfectly still reservoir of the Kennet and Avon canal; and the results of seventy similar experiments made on a smaller reservoir, at Chew Magna, Somerset.

May 13*th*, 1851.

The paper read was,—*On the pneumatic method adopted in constructing the foundations of the new bridge, across the Medway, at Rochester.* By Mr. JOHN HUGHES, Assoc. Inst. C. E.

This bridge was described as being designed to consist of three large openings (a central one of 170 feet in width, and two

others, each of 140 feet in width, spanned by cast-iron segmental girders), and of a passage, to admit masted vessels to the upper parts of the river, across which a moveable bridge would be placed. Each of the river piers occupied an area of 1118 square feet, and rested upon a series of cast-iron cylinder piles, 7 feet in diameter, placed 9 feet apart longitudinally, and 10 feet transversely,—so that there were fourteen under each pier. The cylinder piles in the abutments were 6 feet in diameter, of which the "Strood" abutment required thirty, and the "Rochester" abutment twelve. Each pile was composed of two, three, or more cylinders, 9 feet in length, bolted together through stout flanges: the bottom length had its lower edge bevilled, so as to facilitate the cutting through the ground. The bed of the river was originally presumed to consist of soft clay, sand, and gravel, overlying the chalk; and accordingly the application of Dr. Potts' pneumatic method for forcing the cylinder piles into the ground (which had been successfully carried out in similar positions) was contemplated; but, after a few trials, the ground was found to consist of a compact mass of Kentish rag stone; so that the mere atmospheric action upon the piles, induced by a partial vacuum, would be ineffective in such a situation. It was therefore decided, that the pneumatic process should be reversed, so as to give each pile the character of a diving-bell; for which purpose one of the cylinders—7 feet in diameter, and 9 feet in length—had a wrought-iron cover securely bolted to it, through which two cast-iron chambers, D-shaped in plan, with a sectional area of about 6 square feet (appropriately called "air locks"), projected 2 feet 6 inches above the top of the cylinder, and 3 feet 9 inches below the cover. The top of each air lock was provided with a circular opening, 2 feet in diameter, with a flap working on a horizontal hinge, and an iron door, 2 feet by 3 feet 4 inches, with vertical hinges below the cover; and each air lock was also furnished with two sets of cocks,—the one for forming a communication between the cylinders and the chamber,—the other between the chamber and the atmosphere. Compressed air was supplied to the cylinder pile by a double-barrelled pump, 12 inches in diameter, and 18 inches stroke, driven by a 6 H. P. non-condensing steam engine. At first the expelled water was made to pass into the river, from beneath the lower edge of the pile; but when the stratum became so compact as to oppose a high degree of resistance to the passage of the air, an outlet was formed through the side of the uppermost cylinder, by the introduction of a pipe, having the form of a syphon, the long leg of which reached to the bottom of the pile, and was subject to the pressure of the condensed air on the surface of the water within; whilst the short leg, leading into the river, had the effect of relieving the amount of compression, provided a vacuum was once obtained in the body of the syphon. Such an effect was readily produced by connecting the summit with the exhaust side of the

air pumps, by a pipe which could be opened or closed at pleasure. To insure the downward motion of the pile, and to give it a weight which should be at all times superior to the upward pressure, two stout trussed timber beams were laid on the top of the cylinder, in a direction suitable for bringing the adjacent piles into action as counterbalance weights, by four chains passing over cast-iron sheaves.

Two light wrought-iron cranes were fixed inside the cylinder, the jibs of which swept over the space between the air locks; and there were windlasses, inside and outside, for the purpose of hoisting the loaded buckets, and lowering the empty ones.

The method followed in working the apparatus was found to be so simple in detail, as to be perfectly intelligible to all the workmen employed. The pumps being set in motion, the flap of one of the air locks, and the door of the other, were closed. A few strokes compressed the air within the pile sufficiently to seal the joints; and whilst the pumping was in progress, the men passed through the air locks to their respective stations. When the water was shallow, the pile descended, by scarcely sensible degrees, as fast as the excavation by hand permitted; but when the water was deep, the excavation was carried down full 14 inches below the edge of the pile, which then descended at once through the whole space, as soon as the pressure was eased off.

The most perfect certainty and success had attended the employment of this simple system, which promised to afford considerable assistance to engineers in the prosecution of similar works.

May 20*th*, 1851.

The paper read was,—*On the isthmus of Suez, and the ancient canals of Egypt.* By Mr. Joseph Glynn, M. Inst. C. E.

The author's attention had been directed to this subject, when the best route to India was under discussion, and that by the River Euphrates to the Persian Gulf was contended for, as offering advantages superior to the one now so successfully adopted through Egypt and by the Red Sea. The possibility of the restoration of the ancient canals in the Desert, naturally formed part of the consideration of the practicability of establishing a communication by water, which should admit of the passage of large vessels from sea to sea.

It appeared that about six hundred years before the Christian era, Darius (Hystaspis) completed a canal from the Nile, a little above Bubastes, to the Red Sea, near to Patumos; this canal—which in some places was nearly 150 feet wide and 30 feet in depth—passed through the valley to the Bitter Lakes, and was navigable for vessels of considerable burden, but only whilst the Nile was high, as it was filled from that source; and it served, by

its branches, for the purposes of irrigation and for the supply of fresh water to several important cities. The ancients assumed that there existed a difference of level between the waters of the Mediterranean and those of the Red Sea; and precautions were taken to prevent inundations, as well as for avoiding any mixture of sea water with that from the Nile.

This canal, after falling into decay, was restored about the year 644 of the Christian era, by the Caliph Omar, who introduced many improvements and changed its junction with the Nile to a spot near Cairo, which had the effect of keeping the navigation open for a longer period during each year. The gradual decadence of Egypt, however, induced the degradation even of this great work; so that after about one hundred and twenty years the channel became choked up; and for above one thousand years it remained neglected and almost forgotten, until Napoleon, at the time of the French expedition, directed a complete survey to be made by Monsieur Le Père, an engineer of eminence, whose report and survey and estimate for construction, with a line of levels from the Mediterranean to the Red Sea, were published in Denon's "*Description de l'Egypte.*"

It was proposed to follow nearly the old line of canal, dividing the length into four sections, at such levels as should enable the navigation to continue open for nearly eight months each year. The entire cost was estimated at about twelve hundred thousand pounds sterling.

The direct distance from the northern extremity of the Red Sea to the Mediterranean being about seventy-five miles, the length of canal would be about ninety-three miles, through a low barren sandy plain, offering no obstacles to the speedy execution of any engineering work, and traversing many lagoons and lakes,—the level of whose bottoms was stated by the French engineers to be from 20 feet to 54 feet below high water mark in the Red Sea, at Suez.

The mean rise of the tide in the Red Sea was found by M. Le Père to be about 5½ feet to 6 feet, and that in the Mediterranean about 1 foot. The surface of the former at high water being stated to be about 32½ feet (English) above low water at Tyneh in the latter.

The various points of elevation above the Mediterranean would be thus:—

High water at Suez	30½	feet, French.
Low water at Suez	25	"
Mean difference	27¾	"
Extreme rise of the Nile at Cairo, in ordinary seasons	39½	"
Lowest point of the Nile at Cairo, in ordinary seasons	16	"
Mean difference	27½	"

Consequently, the Nile, during the height of the inundation, at

Cairo, would be 9 feet above high water level, and 14 feet above low water level at Suez.

M. Prony, M. Michel Chevalier, and Colonel Chesney, considered the construction of a canal practicable, in a country where no physical impediments existed, and where labour could be obtained, perhaps, at a cheaper rate than in any other part of the world.

In the discussion which ensued, and in which Mr. R. Stephenson, M.P., Colonel Hamilton Smith, Mr. Ayrton, Mr. Greaves, and the author of the paper took part, it was shewn, from recent careful levellings and personal examination, that the levels of low water in the Red Sea and the Mediterranean were identical, and therefore that the project of M. Le Père, being based on a presumed difference of upwards of 30 feet between the seas, was not feasible; but that the error in the levels might be accounted for by the fact that the work was executed during a period of war of the most harassing description.

It appeared, that the ridge now existing at the end of the Red Sea, towards the Bitter Lakes, consisted of tertiary strata, the fossils of which were identical with those of the London basin and the hill of Montmartre (Paris), and that it had no doubt resulted from a geological upheaval which had materially changed the features of the district. If this position were correct, there was little doubt that originally the Bitter Lakes formed the head of the Red Sea; and the ruins of Serapeum, and of other extensive towns around, indicated that the district had, at a remote epoch, possessed great fertility, it having been irrigated by the canal of Sesostris, by which Lake Temsah was supplied with fresh water, and deserved the name of "Goshen," the "Land of Promise."

This interesting discussion terminated the business meeting of this part of the session, which was announced to be resumed on the second Tuesday in November.

INSTITUTION OF MECHANICAL ENGINEERS, BIRMINGHAM.

J. E. McCONNELL, Esq.,—in the Chair.

April 23rd, 1851.

On the ventilation of mines.—By Mr. Benj. Gibbons.

In this paper, the author confines himself principally to the means of ventilation adopted in the South Staffordshire Coal Mines, which have veins varying from 24 to 30 ft. in thickness,—observing, at the same time, that the principles are equally available to the thinner veins of other districts; for it is obvious that it is much more difficult to drain the upper part of the coal, of the great thickness of 30 feet, of its carburetted hydrogen, than that of thinner veins.

This arises from the great levity of the carburetted hydrogen issuing out of the coal; which explosive gas will always rise to the highest point as soon as it is released; and it is plain that, in excavating coal of this great thickness, large masses must be detached, and pockets or hollows must be formed, which are instantly filled with this gas; whilst a thin vein, in which a level roof can be generally secured, or nearly so, can be kept free from accumulations of this gas with much greater facility.

In December, 1846, in consequence of a frightful explosion which took place at Oldbury, the author was induced to publish a small work, descriptive of the principles of ventilation adopted and practised by him for many years before in the thick and thin mines that were worked under his personal superintendence.

The author first recapitulates the substance of a part of his work, and gives, in addition, the results of an enlarged experience, as well as a slight notice and reply to some of the objections made to his plan.

Carburetted hydrogen gas, which produces these dreadful explosions, is not explosive until it is united with a certain proportion of ordinary air—say seven to nine times its volume; when this mixture has taken place, it arrives at what is termed its "firing" or explosive point; and in that state, if it come in contact with the flame of a candle, it will instantly explode, with similar rapidity and violence to gunpowder. A considerable volume of this gas is set at liberty in all the thick coal mines, when worked in the usual manner, and as often as fresh masses of coal are cut through. Some coal mines supply a much larger quantity of gas than others; and these are commonly called "fiery mines;" but, in all coal mines, a sufficient quantity is extricated to produce the most direful consequences, if it be not neutralized, or its escape duly provided for.

The general mode is that of diluting the gas with a quantity of atmospheric air; and a current of air, equal to thirty times the volume of gas yielded by the coal, is, in the author's opinion, the bare limit of safety: that is to say, thirty cubic feet of common air must circulate through the mine in the same space of time that the coal will give out one cubic foot of gas; but the quantity of air should exceed this, where this mode of ventilation is practised; for a copious supply of fresh air is needful for the numerous workmen, horses, and candles, employed in the pit.

Many mechanical plans have been recommended to increase the current of air through the mines;—in some, force-pumps, and in others, exhaust-pumps, have been proposed, to produce an artificial current of air throughout the workings. These plans, theoretically, may be very correct; but, it is to be observed, that the current of air must be constantly maintained; and, in the practical application, the engine that works these pumps, or other mechanical means, may get out of order, and thereby endanger the lives of all the miners. This fatal objection attaches to all

mechanical plans for ventilation; and, indeed, to all artificial modes, where the power of ventilation is not self-acting—but requires the constant action of machinery, or the constant aid of men; even including the ordinary plan of rarefaction of the air by a separate fire, which may be out when it ought to be in, and ought not to be relied upon as the sole protector, though it will be, in some circumstances, a useful auxiliary.

We should therefore avail ourselves, as far as possible, of the natural powers that are at our command; and, in this instance, the extreme levity of the gas, from which we wish to rid the mines, supplies us, to a considerable extent, with the remedy required. But cases may arise where other auxiliaries may be temporarily required, from accidental displacements of the level of the mine; although, in the author's opinion, these cases may be reduced to a few, if the mines are opened out and worked upon a proper system, as will be further noticed in this paper. Under these circumstances, it may be necessary to employ heat, to rarefy the upcast current of air, to make it specifically lighter than the downcast; or mechanical means, to force air in, or to extract air from the mines, may be required. Where artificial heat is made use of, a steam-jet, from the boiler of the winding-engine, is the most secure method; because, the steam being supplied from the boiler of the winding-engine, it is clear that the steam is always at command whilst the pit is at work. If mechanical means should become necessary, Mr. Struvé's exhausting cylinders supply the most powerful and effective apparatus that has fallen under the author's notice.

The object of the present paper is to show that there is a constant self-acting power available, which experience has shown will afford the desired protection in ordinary temperatures, in the majority of cases; because, the carburetted hydrogen of the mines being less than half the weight of common air (it has an equal ascending power to common air heated to 512 degrees, being of the same specific gravity), will always rise to the highest parts of the mine, and would escape with great velocity, if permitted to do so; forming, in the aggregate, a very large ascending power, as exemplified in the balloon; but, in the ordinary system of working, this escape is unprovided for—indeed, absolutely prevented.

According to the ordinary system adopted in the collieries of this district, two shafts are sunk, near together, about 7 to 7½ feet in diameter, each to the bottom of the coal—say about 180 yards depth—the two shafts commencing at the same level, and terminating at the same level. One of these becomes the "downcast pit," down which the air descends, and the other the "upcast pit," up which the air ascends, when a communication is made between them at the bottom; but the only determining causes for the motion of the air being accidental, it is unknown beforehand what direction the current will take, and which will become the

downcast pit. It is generally found that a current of air does take place (it may almost be said always takes place), without any other means being employed; but the determining power is so faint, that, issuing from the upcast pit with such trifling velocity, it is liable to be deranged by the action of the wind, or by atmospheric changes; and it sometimes happens that the air becomes quiescent, or an unsteady column, alternately ascending and descending the same shaft; and then, in miners' language, the pits "fight," and the air will neither ascend nor descend with regularity in one direction. But worst of all, the course of the air will be sometimes inverted or "turned"—that which should be the downcast pit becoming the upcast; and the mine then becomes exposed to the most fearful results, where the workings have been opened,—by the air being driven backwards along the air-head into the reservoirs of gas formed in the upper cavities of the workings, and issuing into the gate-road,—charging the gas to the firing point.

The danger of this change in the direction of the air current is seriously increased by the upcast pit being used as a working shaft. The upcast pit (which is, in fact, the main gas and air-way, and which ought always to be closed from the external air, and the ascending air current guarded from disturbance or commotion, to prevent the slightest interruption to the current of air upon which the lives of all depend) is kept in a state of constant agitation by the ascent and descent of the "skips," loaded with coal, which nearly fill the shaft. To crown this, when every skip arrives at the top of the shaft, a carriage, boarded over, called the "runner," is wheeled over the mouth of the pit whilst the coal is landed, and then withdrawn to allow the skip to descend. It is obvious that the air, which should never be disturbed, is thus constantly liable to be in conflicting currents, more or less—sometimes upwards and sometimes downwards; and whenever the mouth of the shaft is covered by the runner, the air is in a state of partial stagnation. But it sometimes occurs that the chain or tackle, by which the skip is suspended, breaks during the ascent in the upcast shaft; the skip then drops down the shaft—drives the air before it with great velocity along the air-head—and forces the gas out of the cavities into the workings, down upon the candles of the workmen; and this the author has known to happen many times.

When the two pits are sunk down through the stratum of coal 30 feet in thickness, a "gate-road" or horse-way is next driven in the bottom of the coal, from 8 to 9 feet high, and about the same width—commencing from the bottom of the downcast pit.

At the same time (or rather before, as it should always precede the gate-road) an air-head is driven about the middle of the coal, or 15 feet high from the "floor" or bottom of the coal—commencing from the downcast pit. The gate-road and air-head are then driven in parallel lines—at the same level upon which they

commence—for the distance of 100 to 500 yards, or more, according to the quantity of coal intended to be cleared by the pits.

A series of "spouts" or openings are driven upwards from the gate-road into the air-head, at intervals of 10 or 15 yards (as the coal may give out more or less gas), to carry off the gas, and produce a current of air for the workmen—each spout being closed up when a new one is made in advance. The excavation of the whole thickness of the stratum of coal, 30 feet thick, is then proceeded with, by opening right and left from the end of the gate-road, and excavating a "side of work," which forms a rectangular cavity—say about 90 yards long by 50 yards wide, or about an acre—the whole of the coal being taken away, as far as practicable, excepting the pillars of coal (generally 10 yards square and 10 yards distant from each other) which are left to support the superincumbent strata.

The air, descending the downcast pit, and travelling along the gate-road into the workings, ascends to the air-head, and, traversing that, ascends the upcast pit, carrying with it the gas and impure vapours—as far as such imperfect and interrupted means will effect—and delivering them into the open air.

By this plan we may contrive (where this system is adopted) to ventilate the mine, though imperfectly, until the lower 15 feet of the coal is excavated; but where the whole thickness of the coal above the air-head has been removed, by undergoing the coal from the bottom, and dropping it down in large masses, the upper portion of the cavity, being above the level of the air-head, forms a reservoir for gas, which gradually accumulates, and has no means of escape,—a reservoir of the capacity of some hundred thousand of cubic feet, which may be wholly or in part occupied by gas. An accidental change in the direction of the current of air would turn the course of the air along the air-head into this reservoir of gas, and from thence into the gate-road, and render an explosion very probable. After the coal is extracted, a solid wall or "rib" of coal, from 6 to 10 yards thick, which is commonly termed a "fire rib," is left all round the chamber, separating it from the next workings; and the entrance from the gate-road is securely walled up, to exclude the air, and prevent spontaneous combustion, which would otherwise, in a short period, take place. When an explosion occurs, it is generally followed by a second, or more, as portions of the gas become successively charged with the due proportions of air; and the liability to these terrible explosions will always remain in mines thus worked, till, by some efficient means, the gas can be allowed a continuous escape, and a current of air can be ensured to move always in one direction, with sufficient power to overcome all extraneous disturbing forces, either of the wind or any atmospheric changes.

In Plate XVI., the system adopted and carried into operation by the author is shewn. One pit *a*, is sunk, instead of two; and in the side of the shaft a smaller shaft *b*, is cut, to form

an "air chimney," and is afterwards separated from the main shaft: this air chimney is circular, and may be made about 3 feet diameter inside, or more, as may be required. The air chimney is bricked at the same time with the shaft,—the circular brickwork of each forming a partition of double thickness and secure strength, from the two arches abutting against each other.

The gate-road *c*, is driven from the shaft at the bottom of the coal, as in the ordinary plan; but the air-head *d*, is driven from the air chimney within two feet of the top of the coal, or higher, if practicable, and runs into the vertical air chimney. The gate-road and air-head are carried forwards in a parallel direction to the extent of work, as before described in the ordinary system; and "spouts" or openings *e*, are driven upwards to connect them, at about every 15 yards—every spout being bricked up close, in succession, when a fresh one is made in advance, so as to make the current of air traverse the whole extent of the gate-road before it rises up to the air-head and passes away to the air chimney. These spouts can only be driven perpendicularly upwards from the gate-road to the air-head; and each of them being about 18 feet long in the 30-feet coal, a formidable practical difficulty was experienced by the author in the King Swinford Pits, where the coal being contiguous to a great fault, it abounded in gas to so great a degree, that when a spout was carried up a very few feet, it became so filled with gas that no man could work in it. But this difficulty was overcome by boring upwards from the spout a hole, 4 inches in diameter, into the air-head: the gas then passed off instantly, followed by a stream of air sufficient to ventilate the gate-road, and to enable the men to work with candles in the spout with perfect safety.

The excavation of the coal is commenced in the same manner as in the ordinary system, by driving at right angles from the end of the gate-road, to begin a "side of work"; and the ventilation is carried on completely and continuously from the extremity of the working, whilst the whole of the coal to the top is removed. The whole of the gas is constantly drained off from the upper surface of the coal by the air-head, and the numerous spouts or cross drains, which remain all open to the air-head, by means of a small pipe-hole left in the stopping as they are successively stopped, and which constantly drain off the gas most effectually, by piercing through and cutting the horizontal layers of coal, and thus tapping the several strata at so many different points. By this system, the danger of any accumulation of gas in the cavities of the upper part of the workings, is effectually prevented.

In the ordinary system of ventilation, it is manifest that only a very slight determining power compels the air to travel constantly in the same direction. Its current is, at all times, weak and insufficient, and liable to be deranged by the action of the wind, or atmospheric changes; and it is under no command whatever. To ensure safety, a constant current of air is indispensably

necessary. It should be a current, too, maintained by natural causes, as far as possible, and never interrupted, for the reasons already assigned; and should be one that will not vary or fail.

To effect this, the ascending column of air must be rendered specifically lighter than the air of the descending column, which circulates through the workings; and this difference of specific gravity must be maintained constantly free from disturbance, by accidental causes, and, to such an extent, as to produce, under all circumstances, a total amount of propelling power that is found sufficient for the complete ventilation of the mine. This is accomplished by conducting the whole of the gas in a continuous ascending column, free from interruption or disturbance, up the separate air chimney; and this ascending power is further increased by erecting a ventilating chimney (shewn, by dots, in the vertical section), of a sufficient height, on the surface of the ground, into the base of which the air chimney is continued, so as to form one uninterrupted air flue, from the top of the ventilating chimney, down to the air-head in the seam of coal. By this means, a long experience has shewn that a constant draught is established and secured, with the occasional aids of a small furnace or steam-jet, which is amply sufficient, in all ordinary cases, to defy wind and weather, and also to produce a current sufficiently strong, that it may be split, and such portions withdrawn from the main stream of air as may be found requisite to carry on the preparatory work to maintain the get of coal.

The air in the gate-road and workings is warmed above the temperature of the air on the surface, in ordinary mean temperatures, by the heat of the earth, and is consequently rarified; this is aided much more than would be generally supposed, by the heat proceeding from the numerous workmen, horses, and candles, employed in the mine; and the current is further increased by the escape of the gases, which are specifically lighter than the air,—the air-head forming, with the air chimney, an uninterrupted and continuous passage from the workings, and delivering the gas into the ventilating chimney: thus a draught is constantly maintained sufficient for all usual purposes. The weak power of draught that exists in the old system is materially diminished by the upcast shaft being of a larger size than the air-head, through which the downward current of air must pass. The ascending current, in consequence, is languid and slow; whereas, in the author's judgment, it should have considerable velocity; and much more important advantages arise from this cause than philosophers either account for or will admit.

Cases may occur, in which it is desirable, for temporary purposes, to increase the draught, either when the external air is at a very high temperature, or from other causes; and this is at once obtained by adding a furnace, or a steam-jet, of any required power, to the ventilating chimney. By means of a fire in this furnace, any degree of rarefaction may be produced that is desired in the ventilating chimney; and it is recommended

always to build one where the boiler chimney cannot be used, that it may be used if it is wanted. In such cases, the flue of the furnace should be carried up perpendicularly, for thirty or forty feet, against the side of the ventilating chimney, before it is opened into it. This precaution will render a deflagration of the gases, passing up the chimney, impossible, when the furnace is used.

The principle of ventilating pits by an air chimney, used for no other purpose than the passage of the gas and the current of air from the workings to the surface, has been adopted by the author, in a more or less perfect form, for more than thirty years, in working the thick and thin mines, and has been found to give a complete and absolute command over the ventilation of every part of the mines. It is only, however, within the last few years, that he has had an opportunity of carrying it through many extensive pits systematically. In the whole of the author's mines, this system of ventilation is now completely carried out. The thick coal is sometimes worked in one pit, and, in another pit, brooch coal, heathen coal, or the white iron-stone lying beneath the coal; and sometimes the thick coal is worked in both. Very little preparation is necessary for this change from one to the other, as the air chimney reaches to the lowest vein; and, a stopping being put in at the level of the vein intended to be got, a supply of air may be immediately procured at any required level. The thick coal abounded in gas in these pits; but it is now so drained, that all difficulties have disappeared. The use of the safety lamp has become a form rather than an essential.

A great improvement is perceptible in the health and comfort of the workmen employed. The air in these pits is always free from gas, and is ten degrees (Fahrenheit) cooler than the neighbouring pits, worked on the ordinary system, owing to the regular supply of fresh air. They have been frequently tried, and found to be sixty-two to sixty-four degrees in the workings; whilst, at the same time, the air in the workings of pits ventilated in the ordinary way, was found, in many cases, to be 72 to 74 degrees: the former, the temperature of a comfortable sitting-room, and the latter, that of a heated cotton-mill.

A great saving of expense from this system will be found also, not only in working the thick coal, but, subsequently, in getting the thinner veins of coal and iron-stone. A considerable amount of outlay, as well as frequently a great loss of time, is incurred in obtaining the necessary supplies of air for working the successive strata of a mine. Whereas, the air chimney is accessible at any point in the shaft; and the shaft is always kept well aired, which is of importance, as it is always found convenient to suspend the workings of the pit, for a considerable time, after the partial exhaustion of one of the strata, and before it may be desirable to commence the working of another.

It may be observed here, that an air chimney may be very easily cut down any shaft which has been sunk in the usual way.

The author has cut one down a shaft during the night, whilst the pit continued to draw coal during the day. He executed one in a pit, one hundred and forty yards deep, in about a month,—the pit continuing to draw coal during the day, whilst the air chimney was made in the night.

Where large quantities of coal are to be drawn, a number of shafts are necessary. Two of these may be sunk at the usual distance of ten or twelve yards, near enough to be commanded by the same winding-engine, but the shafts having no communication with each other. But if the form of the mine makes it more convenient, they may be sunk singly in any required situation; because each separate shaft will provide its own air, and each shaft will "get" the separate section of mine appropriated to it. By this means, small detached portions of mine have been got to advantage, that would not have paid for the expense of two shafts.

By this arrangement, a much smaller quantity of air-heading is required to "get" the same area of coal; and the process of complete ventilation can be more easily carried out, as will be hereafter noticed; and, as communications between different shafts, by the gate-roads, might be occasionally convenient, these communications may be under the care and sole control of the mine director, who may keep the doors locked, if advisable: the ventilation is thus not materially disturbed.

In the different plans for ventilating mines, the merit appears to have been awarded to those more especially who have succeeded in forcing, by any means, either mechanical, or by the use of powerful furnaces, the largest possible quantity of air through the workings in a given time. The principle explained in the present paper is totally different, and diametrically opposite; for it consists in draining the gas away from the coal before it is worked, and then getting the coal when it is thus drained, and carrying no more air through the mines than is required for light, life, and health.

Thus, to illustrate the difference between the two principles of ventilation, supposing that 1000 cubic feet of gas per minute is emitted by the coal, and passed through the workings, 35,000 cubic feet of air per minute must, according to the old method, be passed through the mine—that is, 30,000 feet to dilute the gas, and 5000 feet to supply the workmen, horses, and candles in the workings; but, if the whole of this 1000 feet of gas can be carried off by its own levity, and intercepted from passing into the workings, then the mine will be better and more safely ventilated by 5000 feet of air per minute, than by 35,000 feet in the former case; or, if the whole of the gas cannot be intercepted, then in such proportion as the volume of gas can be intercepted and carried away. And, supposing the opinion of the author to be correct, that the gas can be carried away without passing into the workings, and that, therefore, a very greatly reduced quantity of air is necessary in the mine, it follows that

(the gas being of the same specific gravity as atmospheric air, heated up to 512°) when the gas becomes diffused and united with the air, the volume of air and gas, so united, is of less specific gravity than the air, and will maintain a natural ventilation of considerable power. It may be observed also, that very rapid currents of air through the passages of a mine are always attended with great inconvenience to the workmen, and may be attended with great practical danger, from the circumstance, that the union or perfect admixture of the carburetted hydrogen with atmospheric air, though very rapid, is not instantaneous; and when in a mine not previously drained of its gas, large quantities of the gas, suddenly escaping from powerful "blowers," are driven forwards by a current of air, moving from seven to ten feet per second, it is very conceivable that they are not diffused at once, but carried, in some degree, like a cloud of steam, forwards through the mine, till diffusion has brought a portion to the "firing point:" this, meeting with a light, or being driven, as is possible, through the wire of the safety lamp, will inevitably cause an explosion.

An objection that was made to the adoption of the system was, the possibility of some disturbance of the brickwork, which separated the air chimney from the main shaft, either by a violent blow from the ascending skip (which, of course, could not be the case with the guides that are now generally used), or by any accidental explosion that might take place in the mine, which, it was contended, might force it outwards into the main shaft. A mere inspection of the plan must convince any practical person that such an occurrence is impossible. Any force from without would be resisted by the convex surface of the arch which encloses the small shaft, as any operating from within would be as effectually resisted by the convex surface of the main shaft. Not only did no such occurrence ever take place in the numerous pits where the plan has been used without guides; but even where the air chimney was cut square, possessing so much less resisting power, it remains now perfect and uninjured after a lapse of more than thirty years.

Another objection was, that the air chimney was not of sufficient dimensions to ventilate the mine; and this objection was urged and re-urged in the face of the fact, that the author had expressly stated that cases might occur, where even a seven-feet air shaft might be required and employed to drain very fiery mines. The parties making this objection did not happen to recollect that, in fact, this air chimney was precisely of the same area as the air-head, which they themselves always employed, to form the communication between the workings and the upcast shaft. That, in fact, the air chimney was neither more nor less than a continuation of the air-head from the workings to the surface of the ground; and consequently, the effect of enlarging the air chimney would be to diminish the velocity of the ascending

column, and to lose the increased temperature the air had acquired in passing through the mine.

Another objection was, that in some of the thinner veins no upper air-head could be driven at a sufficient height to allow the gas to escape by its own levity, or to prevent it from getting admission to the workings. There may be exceptional cases—as, for example, if a mine can be supposed to lie upon a perfectly horizontal plane (but the author never saw an instance of a mine to any considerable extent answering this description; in all mines he has ever seen, the coal forms some angle to the horizon in some direction; and a very small angle will soon obtain a height of six or seven feet, which is quite sufficient for the present purpose): in that case the air-head, communicating to the upcast shaft, may be made always to descend to the higher part of the plane, which will be quite sufficient to keep the mine clear from gas, by allowing it to pass off by its own levity. But, even if such a case ever should occur, a remedy may often be obtained, an instance of which has lately occurred to the author. A disturbance in the thick coal vein was found, breaking the coal through and throwing it into a trough 15 yards below its level: of course if the air-head had continued to follow the vein, it must have been depressed below its level to an extent equal to the whole thickness of the coal, which would have formed a barrier against the passage of the gas, like an inverted syphon, which the gas would not have passed. The remedy adopted by the author was, by commencing an air-head from the air-chimney in another measure, the "flying red," that lay 20 yards above the main coal, and continuing it till it had passed over the depressed point; a communication was then formed to the upper side of this depressed part, which at once established a rising air-head for the whole of the coal on the farther side of the depression.

It may be perceived that the plan of ventilation here recommended is combined, in some measure, with the method of working the mines, and may be made more perfect and efficient by the adoption of a sound system. The common mode is that of working the mines in "panes," or "panels," leaving pillars, or portions of coal, to be extracted at a future period; but this is considered by the author as highly objectionable.

The danger of this method must be sufficiently obvious, when it is seen that the air must be forced through the most crooked and winding channels, and compelled to pass along by artificial buildings, or "brattices," the accidental destruction or failure of which may suspend the whole ventilation.

But the plan exhibited will shew that, before any coal is got from the mine, in the method recommended by the author, the roads are carried out to the extreme extent that the coal is proposed to be worked, accompanied by their air-heads: by this means the complete drainage of the gas from the mass of coal proposed to be worked is effected; and these roads and their air-

heads are originally made at infinitely less expense, and are always in a safe and secure state, as the excavations commence at the outside of the coal thus intended to be got; and no brattices are necessary, as double doors may be used in any of those roads down which the air is intended to circulate, either to regulate the quantity, or prevent its passage; and the current of air may be always brought to act directly upon the working face of the coal.

It may be objected that these pillars must be left for a support, owing to the nature of the roof of the mine; but this the author has never yet seen, and is disposed to think that it never can happen. He is getting veins of coal of thirty feet in thickness, (in two successive workings of fifteen feet each) also veins of six feet, four feet, and three feet thicknesses. The roofs of these various coals differ in their tenacity, and some of them are extremely tender, and yet the whole of the coal is extracted from these veins, both the thickest and the thinnest, both large and small coal, with the greatest facility and safety.

The dangers obviated by this mode of working are doubly important; the roof gradually descends as the mine is excavated; all dangers are left behind; and the roof is consolidated into a compact mass by the weight of the superincumbent strata: consequently no "goaf," or hollow, is ever formed, and no lodgement of gas can take place. Secondly—no large or small coal being left behind—the heating of the goaf, or the spontaneous combustion to which all mines are liable where small coal or slack is left, can never take place.

In working mines in panes and pillars (where a part of the coal is left, and eventually lost), the difficulty of obtaining safe ventilation will be understood from the following remark. At Newcastle-on-Tyne, the brattices having been all blown down by an explosion, and the workings filled with carbonic acid gas, and no means existing of quickly restoring the ventilation (as at the Felling Colliery), the pits and workings could not be entered, nor the bodies of the men recovered, for weeks, nay, even months. Every man in the mine, though out of the reach of the explosion, necessarily lost his life by the *after-damp*. A very recent case in Scotland, at Nitshill, where sixty-one lives were lost, is a striking example: although this pit had a good and distinct upcast shaft, the brattices were destroyed, the air of course proceeded along the shortest and most direct road from the downcast to the upcast shaft, and all the men who had been supplied with air by the diversion of the currents, depending entirely upon brattices (which were destroyed by the explosion), miserably perished, and the whole of the bodies could not be recovered in a week's time.

Where shafts are used of large diameter, divided by brattices, and of such large dimensions as to allow one side of the brattice to form the downcast, and the other the upcast shaft, a similar result follows in the event of an explosion to that last mentioned. A part of the brattice (probably at a considerable depth) is rup-

tured, and no current of air can be procured to admit of its repair, except by means which involve loss of much time and expense. In the meantime, all those who may have been in the pit, at the time of the explosion, cannot be approached. The author presumes that some idea of economy introduced this system; but he is satisfied that upon this point an erroneous impression has prevailed. The expense of sinking these single divided shafts (of the usual diameter of fifteen or sixteen feet) is so very great, that it has led to the practice of working very extensive areas of coal by means of a single shaft; and this practice has further led to the different scientific contrivances for impelling the air over these immense areas, by which the ventilation of the works is rendered so much more difficult and uncertain.

Taking, for example, a pit of this description, of fifteen feet diameter, by which is worked an area of 200 acres (and instances might be adduced where four, five, and six times that quantity has been thus worked), it is evident that the ventilation of a coal mine of this description, where the air passages have been extended to the length of seventy miles, must be attended with very great danger and vast expense.

Now the author states, as his opinion, and thinks he should have no difficulty in proving it correct, that four shafts might have been sunk on this area of 200 acres, $7\frac{1}{2}$ feet diameter each, in proper positions, with their air chimneys, for considerable less money than the one shaft cost; and if this can be established, it follows that the 200 acres being divided into sections of fifty acres each, the expense of the underground work would have been most materially diminished, and that the ventilation might have been effected with much greater ease and security in separate sections of fifty acres each, and the power of raising coal doubled, as there would be always two ascending and two descending corves, instead of one.

To sum up the conditions and principles requisite in carrying out the author's plan effectually, it may be stated:—

1st. That the air-head should always open into the highest practicable part of the mines.

2nd. The air-head (or what may be properly called the gas-head), by which is meant the horizontal air or gas passage, shall always be in continuous communication from the workings to a vertical air chimney, or separate shaft, of three, four, five, or more, feet diameter, whichever shall be required; but always of sufficient dimensions to carry off the gas and air from the workings.

3rd. That the air-head, or gas-head, shall not, in any part of its course, be depressed below the level of its opening into the workings.

4th. That the air chimney (of such dimensions as the mine requires), by which is meant the vertical air or gas passage, shall never be used for any other purpose than the passage of the current of the gas and air from the workings to the surface; and that

it shall be closed from the external air, till it arrives at its point of exit.

5th. That the vertical air chimney should be closed at the top, and separated from the shaft, and should then be connected to the ventilated chimney or the chimney connected by a horizontal flue with the boiler, so that the current of air may not at any time be disturbed or interrupted.

6th. That the gate-roads should always be driven to the extreme point to which the workings of the coal are intended to be extended;—that the coal may previously be drained of its gas before any coal is got out: by which means the gate or horse roads, and the air or gas-head, may be made, and afterwards be maintained, at considerably less expense, in a safe and secure state, and the gases be gradually drained off, before it is necessary to get the coal.

The author, in conclusion, states, that the cases must be considered as exceptional, rather than general, in which any insurmountable difficulty, in providing the remedy for accidental derangements of the coal strata, will present itself, and render it necessary to interfere materially with the principles recommended for adoption.

List of Patents

Granted for SCOTLAND, subsequent to 22nd April, 1851.

To Thomas Haimes and John Webster Hancock, of Melbourne, in the county of Derby, manufacturers; Albert Thornton, of the same place; and James Thornton, of Leicester, mechanics, for improvements in the manufacture of knit and looped fabrics, and for raising pile thereon.—Sealed 28th April.

Gaetan Kossovitch, of Myddleton-square, London, for improvements in rotatory steam-engines,—being a communication.—Sealed 29th April.

Hugh Barclay, of Regent-street, London, for improvements in the means of extracting or separating fatty and oily matters; in refining and bleaching fatty matters and oils, animal and vegetable wax, and resins; and in the manufacture of candles and soap,—being a communication.—Sealed 30th April.

Edmund Morewood, of Enfield, in the county of Middlesex, and George Rogers, of the same place, for improvements in the manufacture of metals; and in coating or covering metals.—Sealed 30th April.

John Borland, of Norfolk-street, Strand, London, engineer, for certain improvements in weaving machinery.—Sealed 30th April.

Thomas Beale Browne, of Hampen, near Andoversford, Gloucestershire, for improvements in weaving and preparing fibrous

materials, and staining or printing fabrics,—being a communication.—Sealed 1st May.

Samuel Jacobs, of Highgate Kendal, in the county of Westmorland, cabinet-maker, for certain improvements in printing on woollen, cotton, paper, and other substances; parts of which improvements are applicable also to the purposes of coloring, shading, tinting, or varnishing such substances.—Sealed 2nd May.

Charles Iles, of Bordesley Works, Birmingham, for improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces.—Sealed 5th May.

François Marcellin Aristide Dumont, of Paris, engineer, for improved means and electric apparatus for transmitting intelligence.—Sealed 9th May.

John Alexander Lerow, of Boston, in the United States of America, for certain improvements in sewing machinery.—Sealed 9th May.

Henry Wimshurst, of Limehouse, London, ship-builder, for improvements in steam-engines; in propelling; and in the construction of ships and vessels.—Sealed 12th May.

Henry W. Adams, of Boston, in the United States of America, for an improved means of generating galvanic electricity; of decomposing water, or various electrolytes; of collecting hydrogen; of burning it or atmospheric air, separately or in combination.—Sealed 14th May.

New Patents
SEALED IN ENGLAND.
1851.

To Daniel Dalton, of Spon-lane, in the parish of West Bromwich, and county of Stafford; iron founder, for improvements applicable to railroads. Sealed 26th April—6 months for inrolment.

John Coope Haddan, of Bloomsbury-square, civil engineer, for improvements in the permanent way of railways, in railway and other carriages, and in the manufacture of papier-maché, to be used in making carriages and other articles. Sealed 26th April—6 months for inrolment.

James Bagster Lyall, of 45, Thurloe-square, Brompton, Gent., for an improved construction of public carriage. Sealed 26th April—6 months for inrolment.

Benjamin Hyam, of Manchester, tailor and clothier, for certain improvements in the method of fastening down trowsers, or other articles of wearing apparel. Sealed 26th April—6 months for inrolment.

Jonathan Wragg, of Wednesbury, in the county of Stafford

coach and axle-tree smith, for certain improvements in railway and other carriages. Sealed 26th April—6 months for inrolment.

Robert Milligan, of Harden Mills, near Bingley, in the county of York, manufacturer, for a new mode of ornamenting certain cloth fabrics. Sealed 26th April—6 months for inrolment.

James Nasmyth, of Patricroft, in the county of Lancaster, engineer, and Herbert Minton, of Stoke-upon-Trent, in the county of Stafford, china manufacturer, for certain improvements in machinery or apparatus, to be employed in the manufacture of tiles, bricks, and other articles, from disintegrated or pulverized clay. Sealed 26th April—6 months for inrolment.

Benjamin William Goode, of Birmingham; Richard Boland, of the same place; and James Newman, also of Birmingham; for improvements in chains, chain pins, swivels, brooches, and other fastenings for wearing apparel. Sealed 29th April—6 months for inrolment.

Henry Lund, of the Temple, Esq., for improvements in propelling. Sealed 30th of April—6 months for inrolment.

Philip Webley, of Birmingham, for improvements in the manufacture of boots and shoes, and in rendering the said manufacture waterproof;—also in the machinery and materials to be used therein. Sealed 30th April—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, civil engineer, for improvements in the manufacture of woven and felted fabrics,—being a communication. Sealed 3rd May—6 months for inrolment.

John James Greenough, residing in Washington, in the United States of America, Esq., for improvements in obtaining and applying motive power,—being a communication. Sealed 3rd May—6 months for inrolment.

Gaetan Kossovitch, of Myddleton-square, Gent., for improvements in rotatory steam-engines,—being a communication. Sealed 3rd May—6 months for inrolment.

Edwin Rose, of Manchester, Lancashire, engineer, for certain improvements in boilers for generating steam. Sealed 3rd May —6 months for inrolment.

Charles Cowper, of 20, Southampton-buildings, Chancery-lane, in the county of Middlesex, patent agent, for improvements in coverings for buildings,—being a communication. Sealed 3rd May—6 months for inrolment.

Peter Armand, le Comte de Fontainemoreau, of South-street, Finsbury, in the county of Middlesex, and Boulevart Poissonnière, Paris, in the Republic of France, for improvements in the manufacture of fuel,—being a communication. Sealed 3rd May—6 months for inrolment.

William Smith, of Upper Grove Cottages, Holloway, engineer, for improvements in locomotive and other engines, and in

carriages used on railways. Sealed 3rd May—6 months for inrolment.

Pierre Armand, le Comte de Fontainemoreau, of South-street, Finsbury, London, and Boulevart Poissonnière, Paris, for certain improvements in electric telegraphs,—being a communication. Sealed 3rd May—6 months for inrolment.

William Cooke, of 18, Great George-street, Westminster, civil engineer, for improvements in the manufacture of soda, and the carbonate thereof,—being a communication. Sealed 3rd May—6 months for inrolment.

James Pyke, of Westbourne-grove, Bayswater, for improvements in the manufacture of leather; also in making boots and shoes. Sealed 3rd May—6 months for enrolment.

Alexis Delemer, of Radcliffe, in the county of Lancaster, civil engineer and machinist, for certain improvements in the application of coloring matter to linens, cottons, silks, woollens, and other fabrics; and to linen, cotton, silk, woollen, and other weft; and also in machinery, or apparatus, for those purposes. Sealed 6th May—6 months for inrolment.

William Henry Brown, of Wards End Steel Works, near Sheffield, steel roller, for certain improvements in the manufacture of helves. Sealed 6th May—6 months for inrolment.

Thomas Robert Mellish, of Regent-street, glass manufacturer, for certain improvements in instruments and apparatus for the admission and exclusion of light and air into and from buildings and carriages, and in the manufacture of reflectors of light; parts of which improvements are also applicable to the decoration of articles of furniture. Sealed 7th May—6 months for inrolment.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in apparatus for the generation and condensation of steam for various useful purposes; also improvements in certain parts of engines to be worked by steam, air, or gases,—being a communication. Sealed 8th May—6 months for inrolment.

Harding Hallen, of Burslem, in the county of Stafford, manufacturer, for improvements in gas-burners. Sealed 10th May—6 months for inrolment.

Emilian de Dunin, of Queen Charlotte-row, New-road, in the county of Middlesex, Gent., for improvements in apparatus for measuring persons and for facilitating the fitting of garments. Sealed 10th May—6 months for inrolment.

Thomas Haimes and John Webster Hancock, of Melbourne, in the county of Derby, manufacturers; Albert Thornton, of the same place; and James Thornton, of Leicester, mechanics, for improvements in the manufacture of knit and looped fabrics, and for raising pile thereon. Sealed 10th May—6 months for inrolment.

William Longmaid, of Beaumont-square, Gent., for improvements in treating ores and minerals, and in obtaining various products therefrom; certain parts of which improvements are applicable to the manufacture of alkali. Sealed 10th May—6 months for inrolment.

Charles Morey, citizen of the United States of America, Gent., for improvements in machinery for preparing, dressing, cutting, and shaping stone and other materials made use of for building purposes and architectural decorations,—being a communication. Sealed 10th May—6 months for inrolment.

Edward Wilkins, of 60, Queen's-row, Walworth, in the county of Surrey, Gent., for improvements in labels or tickets. Sealed 13th May—6 months for inrolment.

Edward John Carpenter, of Toft Manks, in the county of Norfolk, Esq., captain in Her Majesty's Navy, for improvements in the construction of ships and vessels, and in machinery or apparatus for propelling and directing the same. Sealed 13th May—6 months for inrolment.

Luke Smith, of Littleborough, in the county of Lancaster, mechanic; Mark Smith, of the Sun Iron Works, Heywood, in the same county, power-loom maker; and Matthew Smith, of Over Darwen, in the same county, manager, for improvements in fabrics, in weaving, and in machinery and apparatus for winding, weaving, cutting, and printing. Sealed 14th May—6 months for inrolment.

Robert Oxland and John Oxland, both of Plymouth, chemists, for improvements in the manufacture and refining of sugar. Sealed 15th May—6 months for inrolment.

William Hemsley, of Melbourne, in the county of Derby, lace manufacturer, for improvements in the manufacture of looped fabrics. Sealed 15th May—6 months for inrolment.

Hugh Barclay, of Regent-street, in the county of Middlesex, for improvements in the means of extracting or separating fatty and oily matters; in refining and bleaching fatty matters and oils; animal and vegetable wax and resins; and in the manufacture of candles and soap,—being a communication. Sealed 19th May—6 months for inrolment.

Perceval Moses Parsons, of Robert-street, Adelphi, civil engineer, for improvements in cranes capable of being used on railways, and in parts of railways. Sealed 19th May—6 months for inrolment.

George Tate, of Bawtry, in the county of York, Gent., for improvements in the construction of dwelling-houses and other buildings, including floating vessels, and for the adaptation and manufacture of materials for such uses. Sealed 22nd May—6 months for inrolment.

Benjamin Bailey, of Leicester, for improvements in the manufacture of looped fabrics. Sealed 23rd May—6 months for inrolment.

James Potter, of Manchester, cotton spinner,—being an extension of a patent, dated 21st December, 1836, for the term of five years, from 26th December, 1850,—for an invention of certain improvements in spinning machinery. Sealed 27th May.

Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in the carbonization of coal, and in the utilization of the products disengaged during that operation, in improving the quality of the products intended for illuminating purposes, and in regulating the flow of the same,—being a communication. Sealed 27th May—6 months for inrolment.

Archibald Slate, of Woodside Iron Works, Worcester, for improvements in steam-engines and steam-boilers, and in the passages and valves for the induction, eduction, and working of fluids. Sealed 27th May—6 months for inrolment.

John Fielding Empson, of Birmingham, for improvements in the manufacture of buttons. Sealed 27th May—6 months for inrolment.

John Harrison, of Blackburn, in the county of Lancaster, for certain improvements in the manufacture of textile fabrics, and in the preparation of yarns or threads for weaving. Sealed 27th May—6 months for inrolment.

William Crane Wilkins, of Long Acre, in the county of Middlesex, engineer, for certain improvements in railway buffers. Sealed 29th May—6 months for inrolment.

Joseph Reynolds, of Vere-street, in the county of Middlesex, card-maker, for improvements in the manufacture of cards, usually denominated playing-cards. Sealed 29th May—6 months for inrolment.

John Pegg, of Leicester, in the county of Leicester, manufacturer, for improvements in producing corrugated surfaces on leather. Sealed 29th May—6 months for inrolment.

Henry W. Adams, of Boston, in the county of Suffolk, and State of Massachusetts, of the United States of America, for an improved means of generating galvanic electricity; of decomposing water or various electrolytes; of collecting hydrogen; of burning it or atmospheric air separately or in combination. Sealed 29th May—6 months for inrolment.

Robert William Sievier, of Upper Holloway, in the county of Middlesex, civil engineer, for improvements in weaving and printing textile fabrics. Sealed 29th May—6 months for inrolment.

John Ashworth, of Bristol, Manager of the Great Western Cotton Works, for certain improvements in the method of preventing and removing incrustation in steam-boilers and steam-generators. Sealed 29th May—6 months for inrolment.

CELESTIAL PHENOMENA FOR JUNE, 1851.

D.	H.	M.	
1			Clock after the ☉ 2m. 34s.
—			☽ rises 5h. 21m. M.
—			☽ pass mer. 1h. 31m. A.
—			☽ sets 9h. 45m. A.
	16	35	☿ stationary
3	9	13	♃'s third sat. will im.
	11	35	♃'s third sat. will em.
4	19	5	♂ in conj. with ♄ diff. of dec. 1. 25. N.
5			Clock after the ☉ 1m. 56s.
—			☽ rises 9h. 47m. M.
—			☽ pass mer. 5h. 21m. A.
—			☽ sets 0h. 8m. M.
	1	0	☽ in Perigee
	9	38	♃'s second sat. will em.
	10	58	♃'s first sat. will em.
6	6	28	☽ in □ or first quarter
7	18	58	♂ in conj. with ♅ diff. of dec. 0. 29. N.
8	2	54	♃ in conj. with the ☽ diff. of dec. 3. 53. S.
9	0	41	Vesta oppo. ☉ intens. of light 1·720.
10			Clock after the ☉ 3m. 47s.
—			☽ rises 1h. 20m. A.
—			☽ pass mer. 8h. 17m. A.
—			☽ sets 2h. 33m. M.
	9	5	♃ stationary
11			Occul. θ Libra, im. 10h. 6m., em. 11h. 18m.
13	6	44	Ecliptic oppo. or ○ full moon
15			Clock before the ☉
—			☽ rises 9h. 50m. A
—			☽ pass mer. 1h. 5m. M.
—			☽ sets 5h. 13m. M.
	11	47	☿ greatest elong. 22. 50. W.
	14	38	☿ greatest hel. lat. S.
16			Juno greatest hel. lat. N.
17	14		Pallas in conj. with ♅ diff. of dec. 11. 2. S.
	17	48	☿ in conj. with Ceres, diff. of dec. 0. 17. N.
18			Mercury R. A. 4h. 10m. dec. 17. 52. N.
—			Venus R. A. 3h. 48m. dec. 18. 36. N.
18			Mars R. A. 2h. 32m. dec. 14. 7. N.
—			Vesta, R. A., 17h. 1m. dec. 17. 37. S.
—			Juno, R. A., 17h. 18m. dec. 4. 12. S.
—			Pallas, R. A., 2h. 5m. dec. 1. 8. N.
—			Ceres R. A. 4h. 9m. dec. 17. 31. N.
—			Jupiter R. A. 12h. 50m. dec. 3. 54. S.
—			Saturn R. A. 2h. 0m. dec. 9. 47. N.
—			Uranus R. A. 2h. 5m. dec. 12. 9. N.
—			Mercury pass mer. 22h. 26m.
—			Venus pass mer. 22h. 5m.
—			Mars pass mer. 20h. 47m.
—			Jupiter pass mer. 7h. 5m.
—			Saturn pass mer. 20h. 12m.
—			Uranus pass mer. 20h. 17m.
19	18		☽ in Apogee
20			Clock before the ☉ 1m. 4s.
—			☽ rises Morn.
—			☽ pass mer. 5h. 5m. M.
—			☽ sets 10h. 21m. M.
	6	53	☽ in □ or last quarter
21	13	41	☉ enters Cancer, Summer com.
23	19	59	♄ in conj. with the ☽ diff. of dec. 3. 3. N.
	21	47	♅ in conj. with the ☽ diff. of dec. 5. 1. N.
24	3	39	♀ in conj. with Ceres, diff. of dec. 2. 8. S.
	20	57	♂ in conj. with the ☽ diff. of dec. 4. 23. N.
25			Clock before the ☉ 2m. 8s.
—			☽ rises 1h. 38m. M.
—			☽ pass mer. 8h. 41m. M.
—			☽ sets 3h. 56m. A.
26	18	45	♀ in conj. with the ☽ diff. of dec. 2. 47. N.
27	7	40	☿ in conj. with the ☽ diff. of dec. 1. 55. N.
29	6	25	Ecliptic conj. or ● new moon

J. LEWTHWAITE, Rotherhithe.

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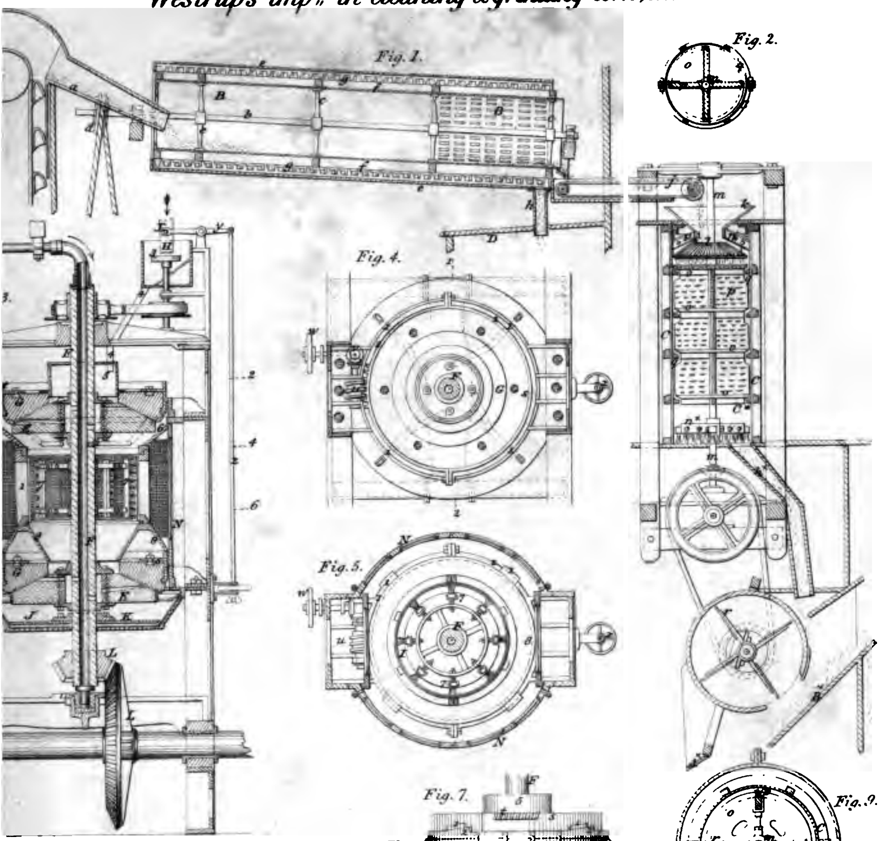
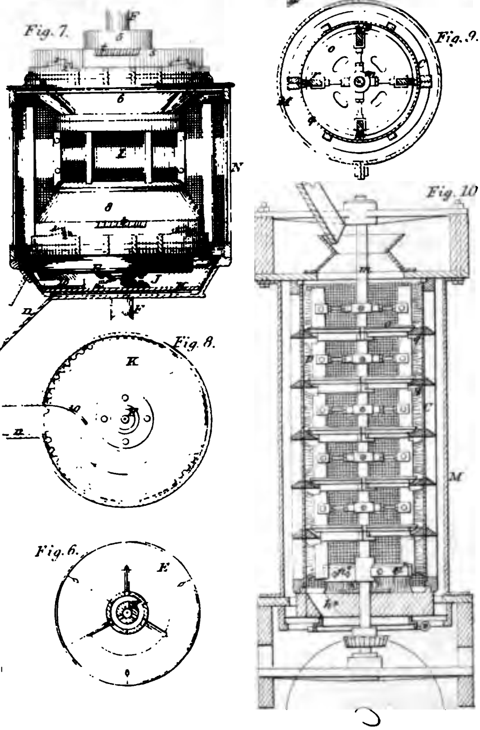
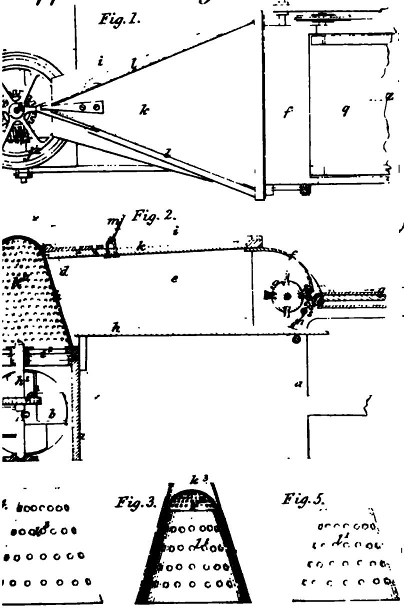
Westrup's imp.ts in cleaning & grinding corn, &c.





's app.ts for making hat-bodies.



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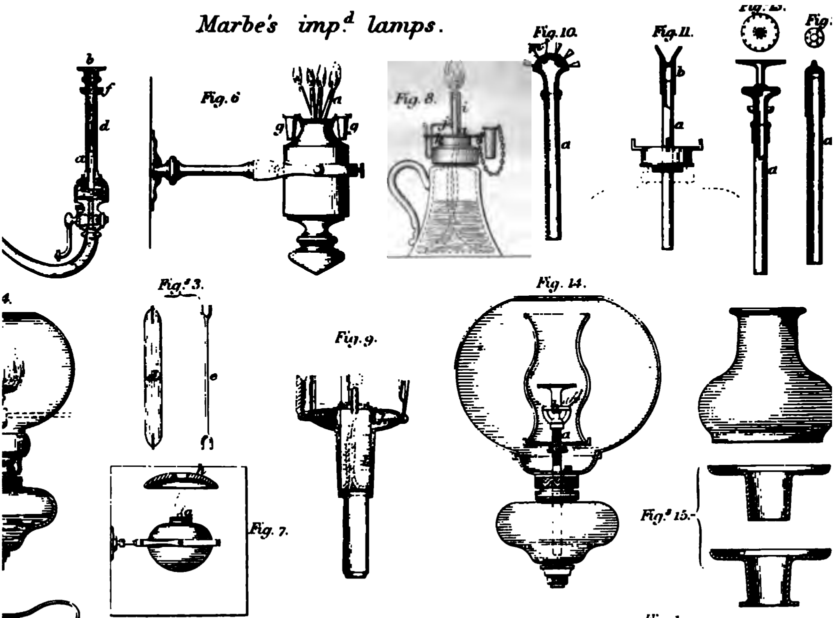
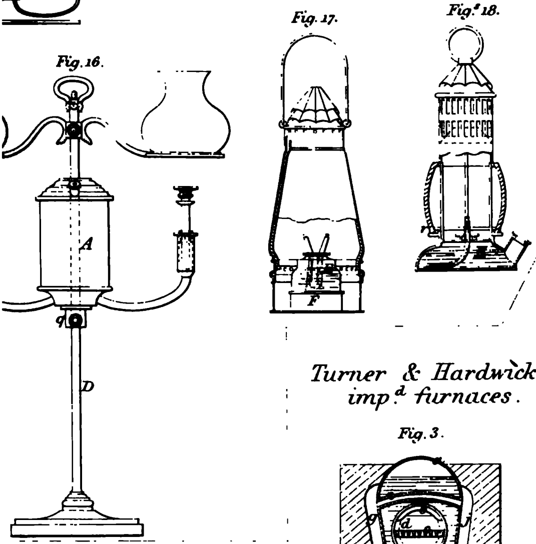
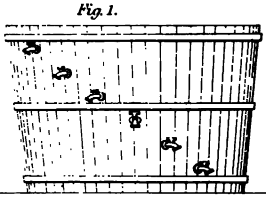
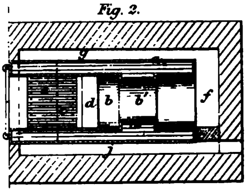
Marbe's imp.^{d} lamps.

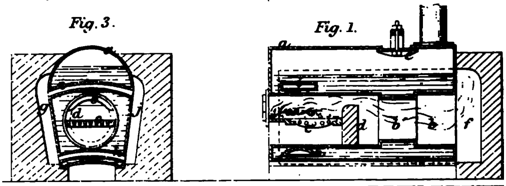




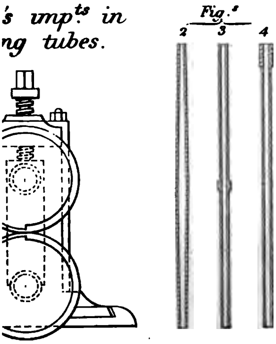




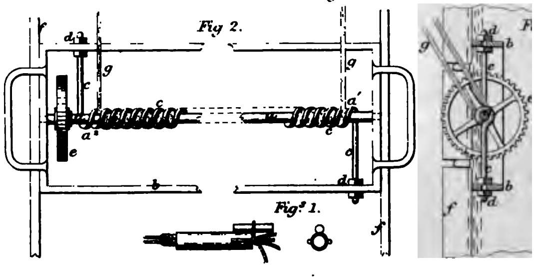
Turner & Hardwick's imp.^{d} furnaces.



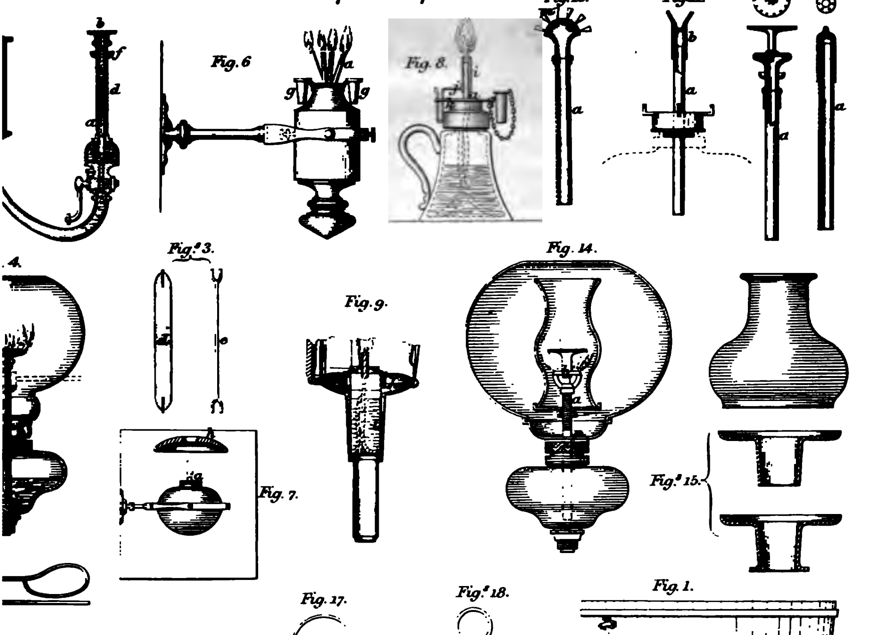
's imp.^{ts} in
ng tubes.

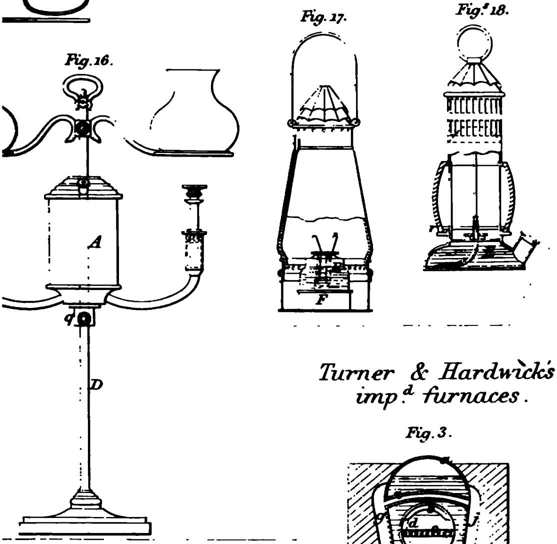


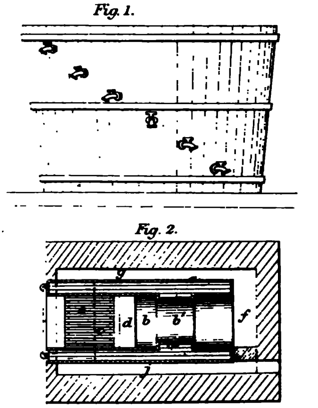
Palmer's wick making mach.^{y}



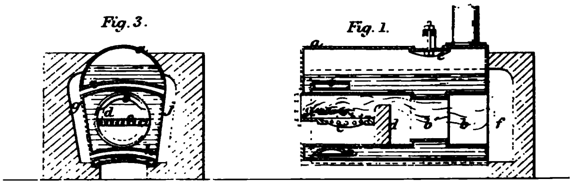
Marbe's imp.^{d} lamps.



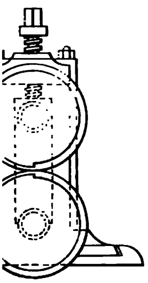




Turner & Hardwick's imp.^{d} furnaces.



...e's imp.^{ts} in ...ing tubes.



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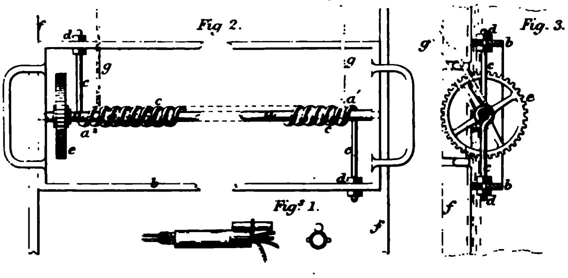
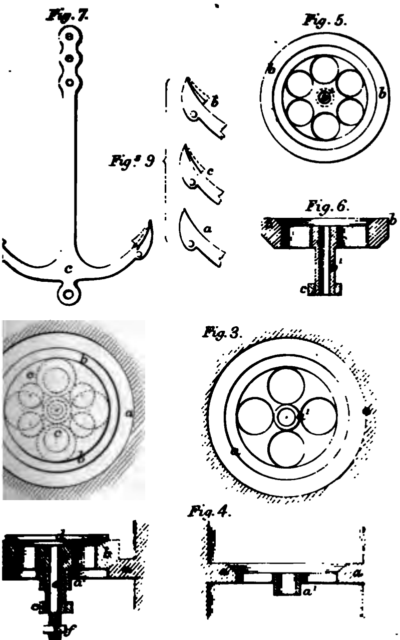
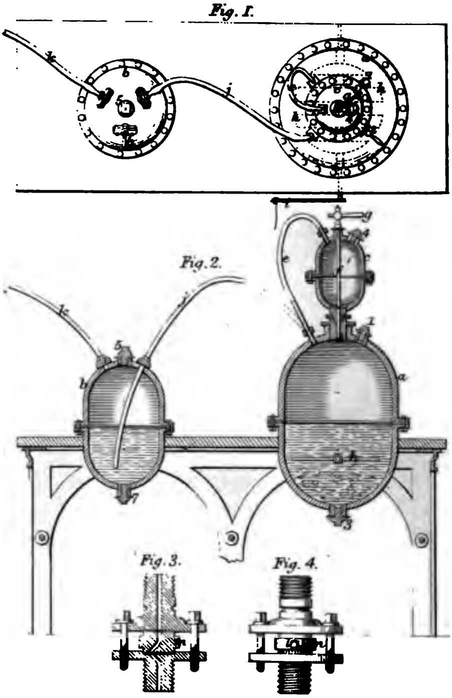


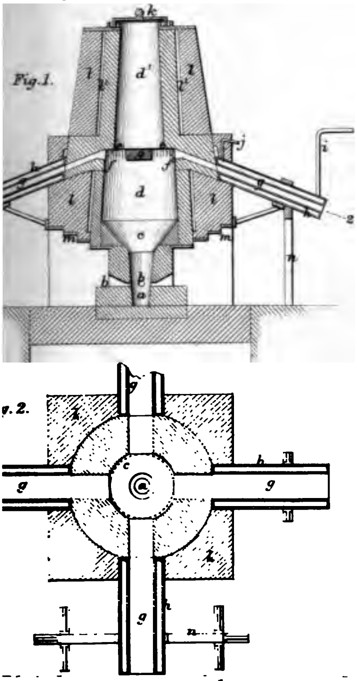
nways imp.ts anchors & valves



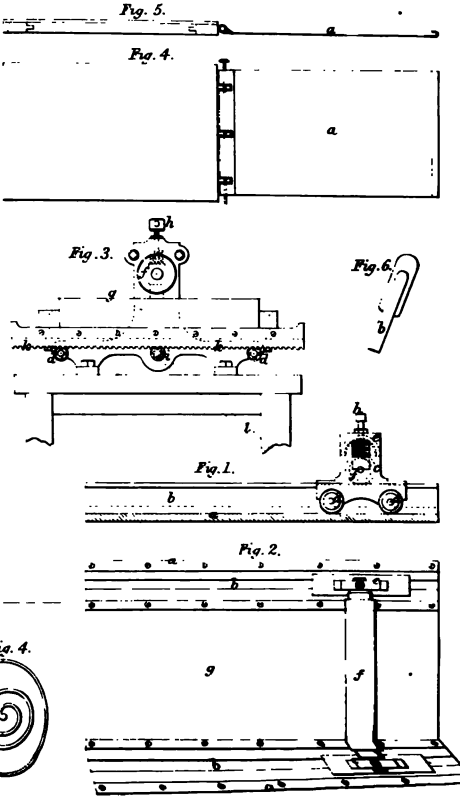
app. for manufacturing ærated waters



's imp.ts in manufacturing Zinc



Waterlow's copying presses



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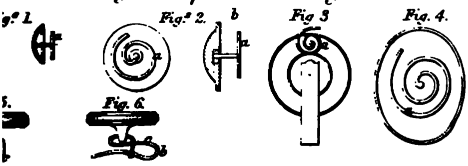
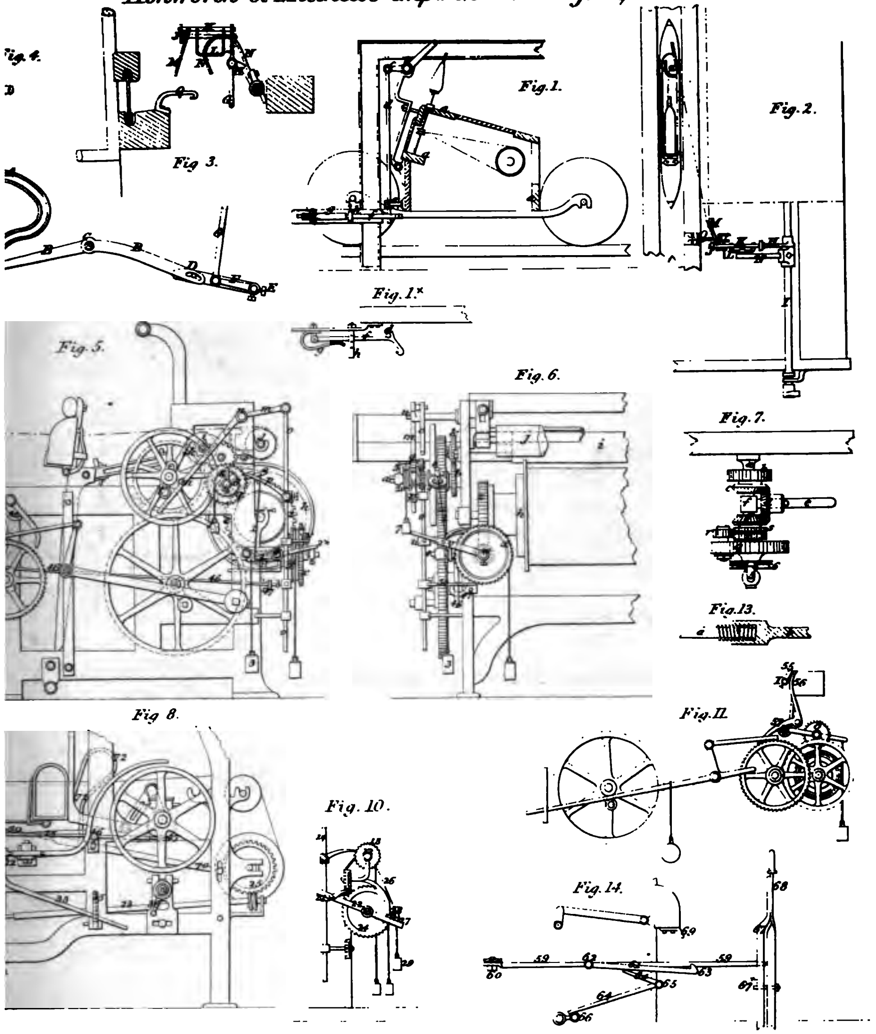
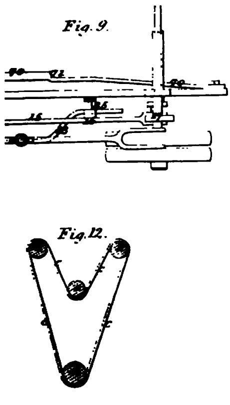
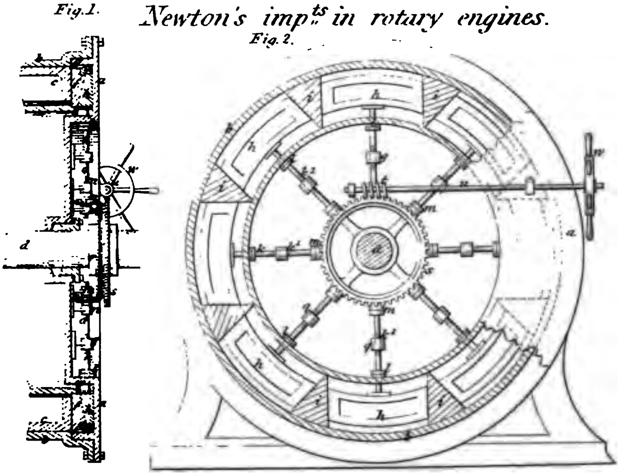


Ashworth & Mitchell's imp.ts in weaving, &c.





Newton's imp.ts in rotary engines.



1st Feby 1851.

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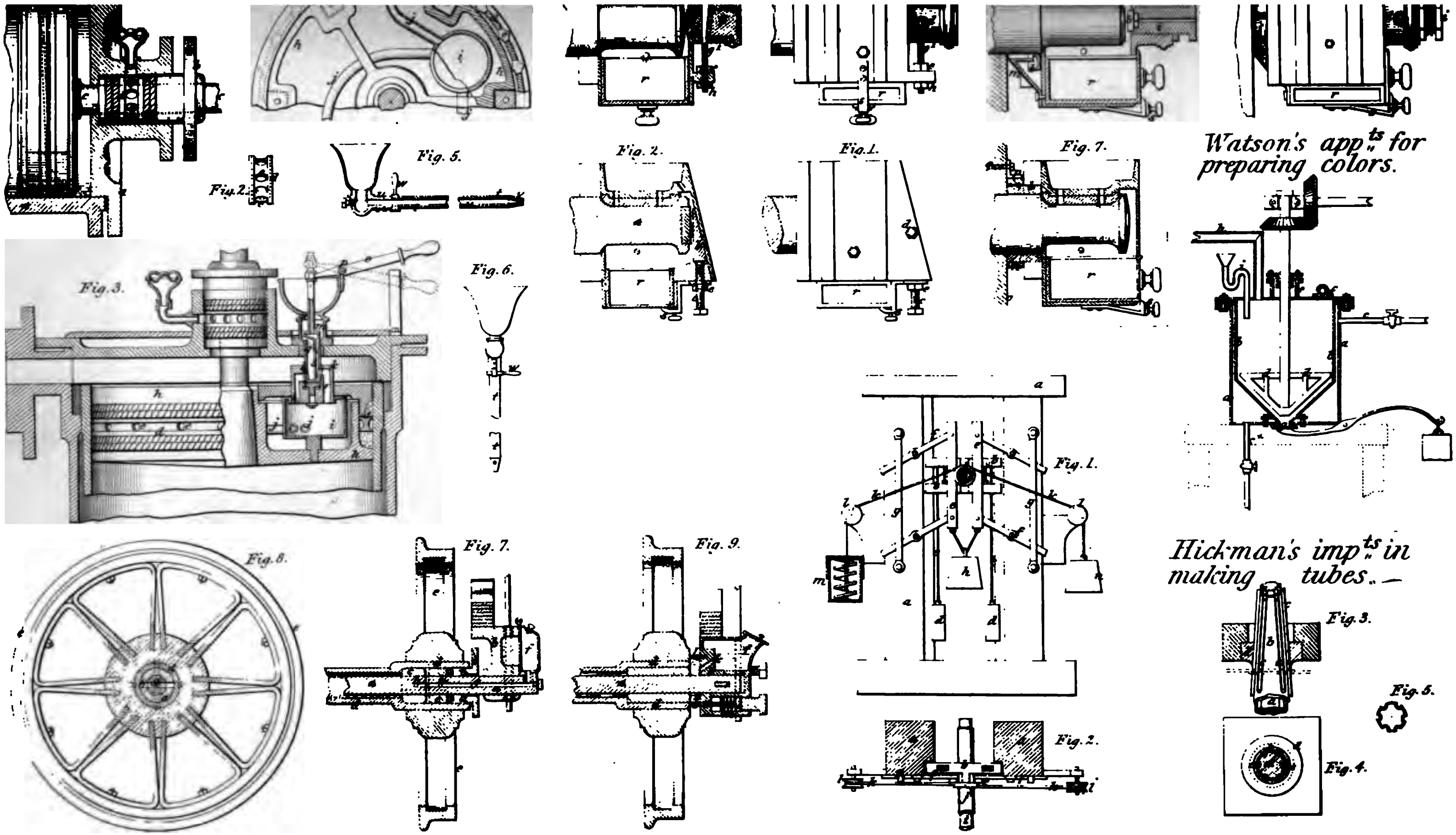

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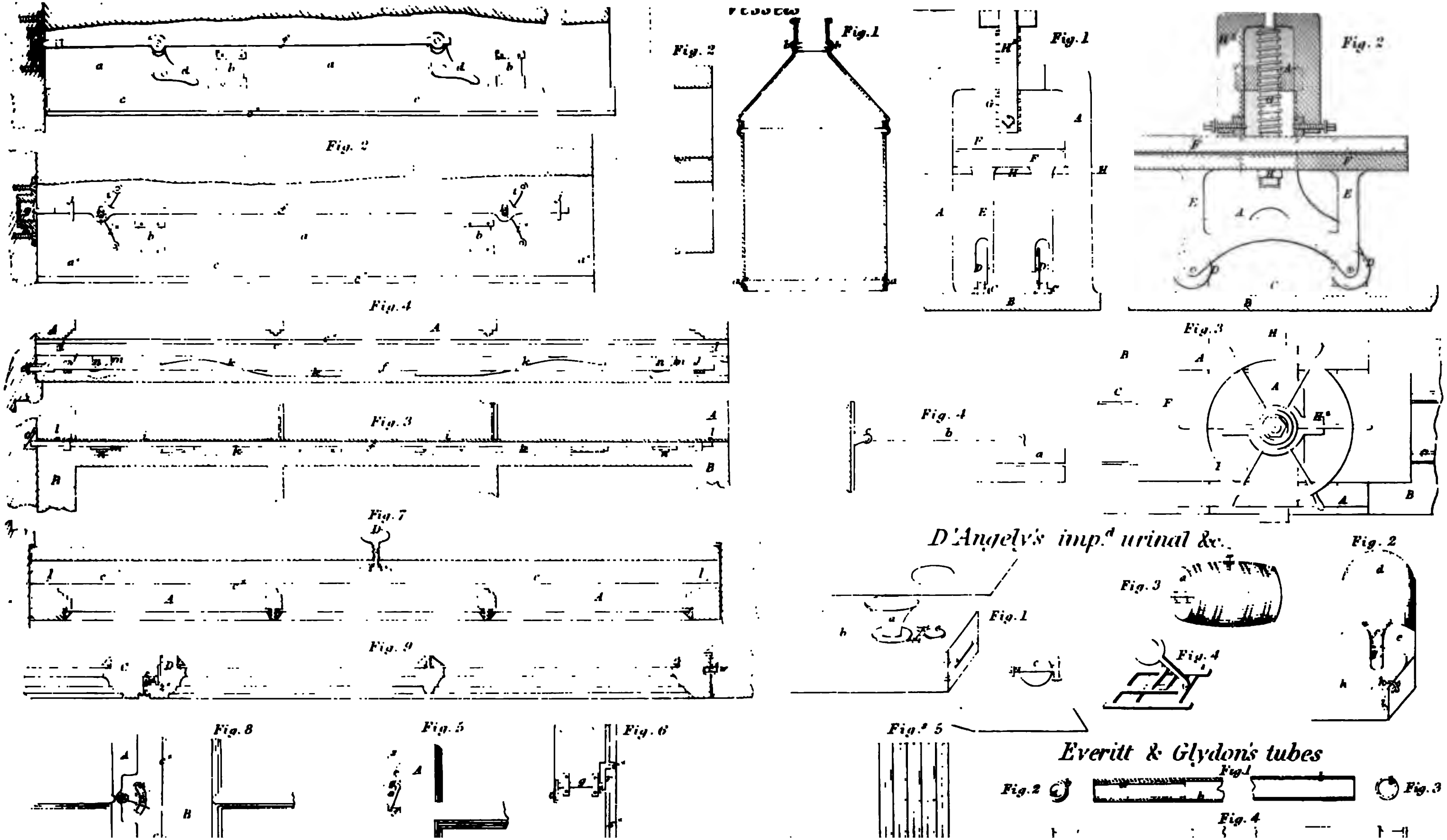
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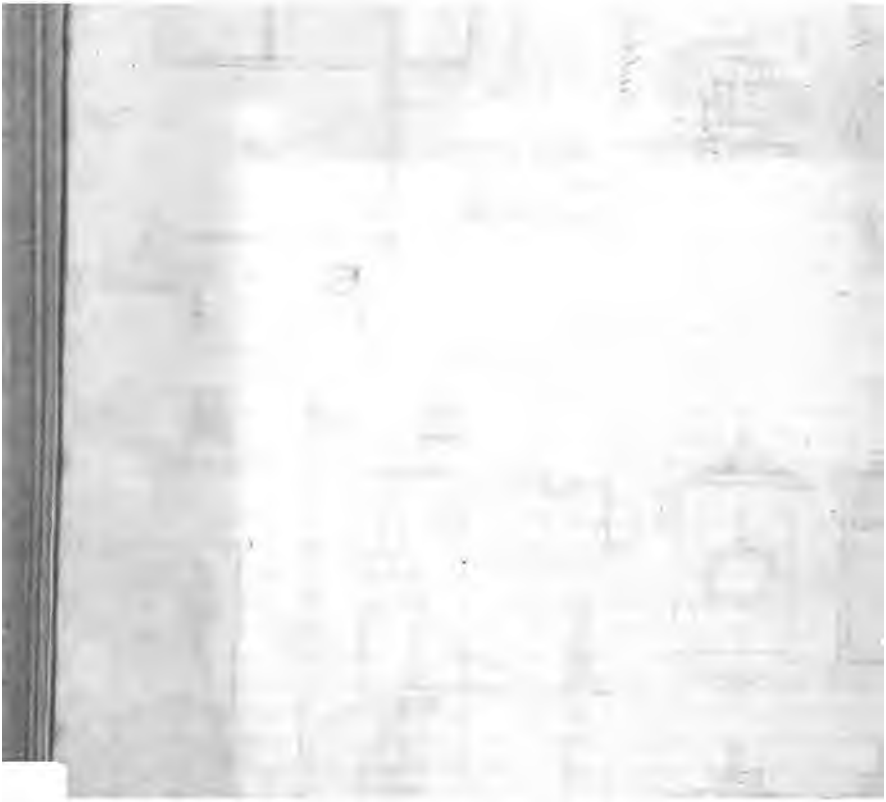
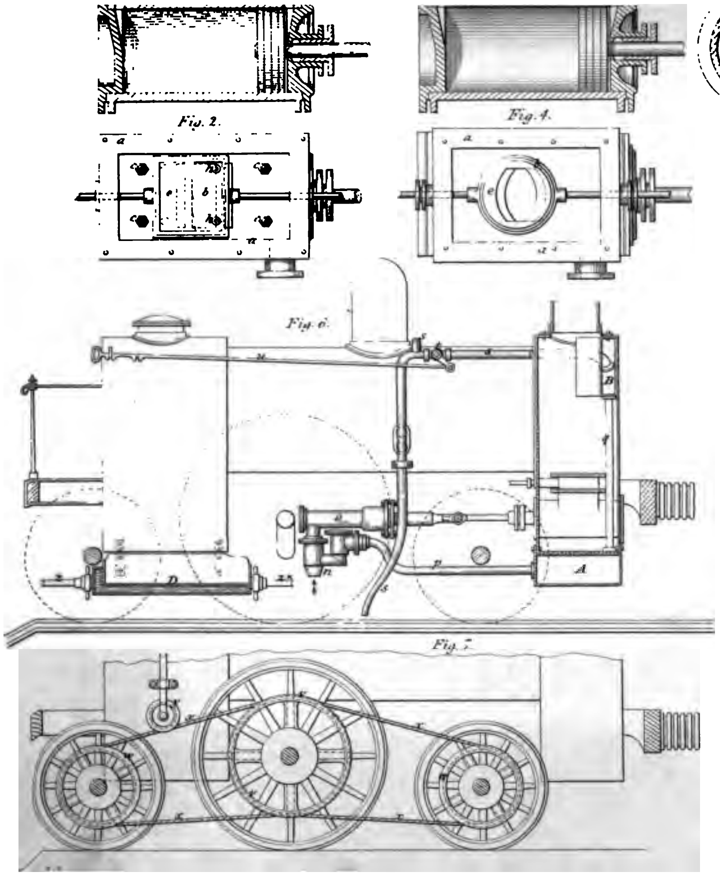
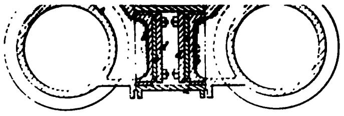
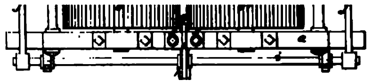
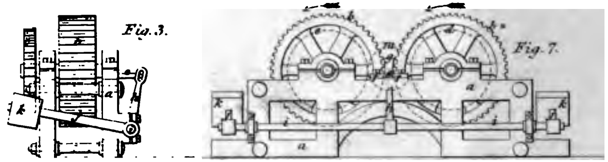




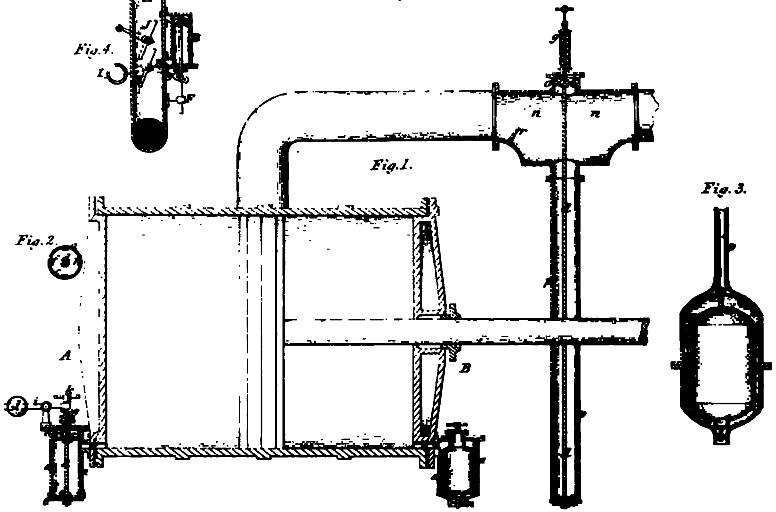


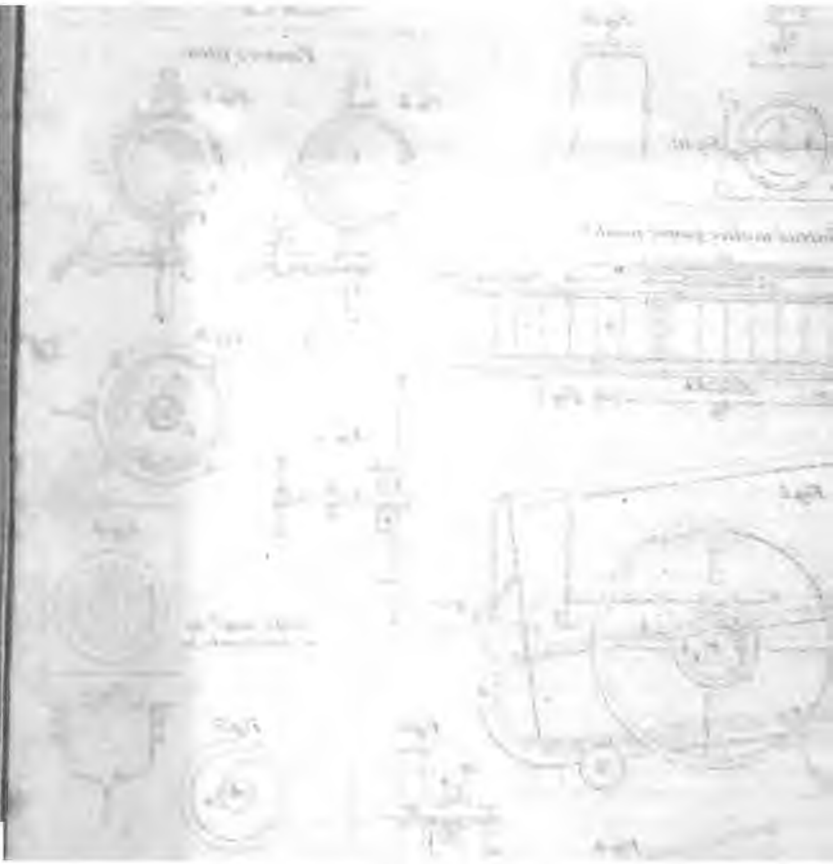


Heath & Thomas' appts. for manufactg. iron.

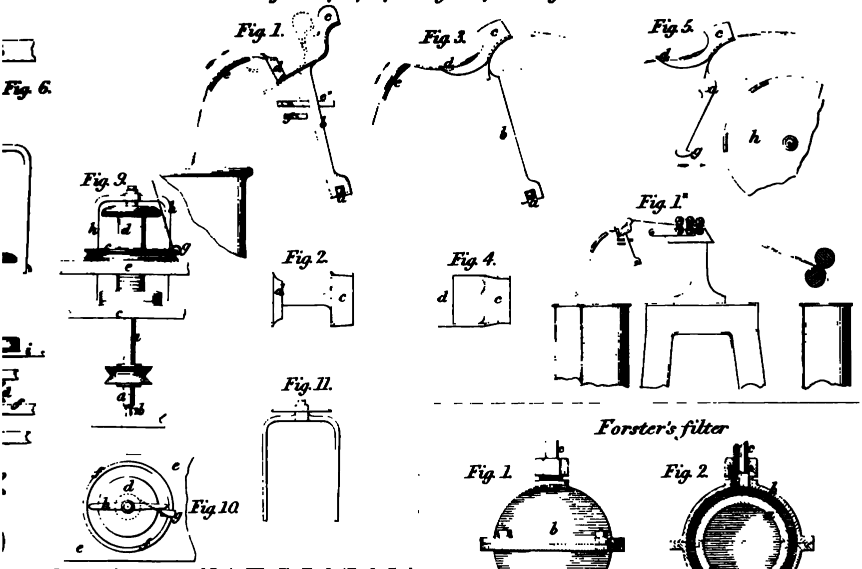


Waddells impts. in steam engines. —

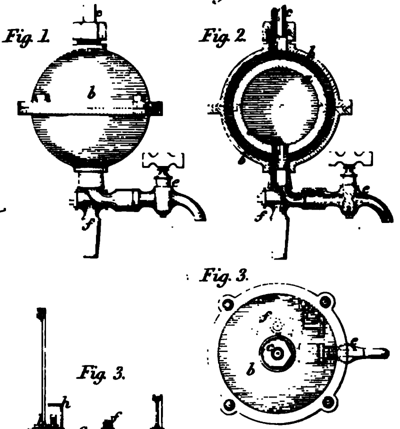




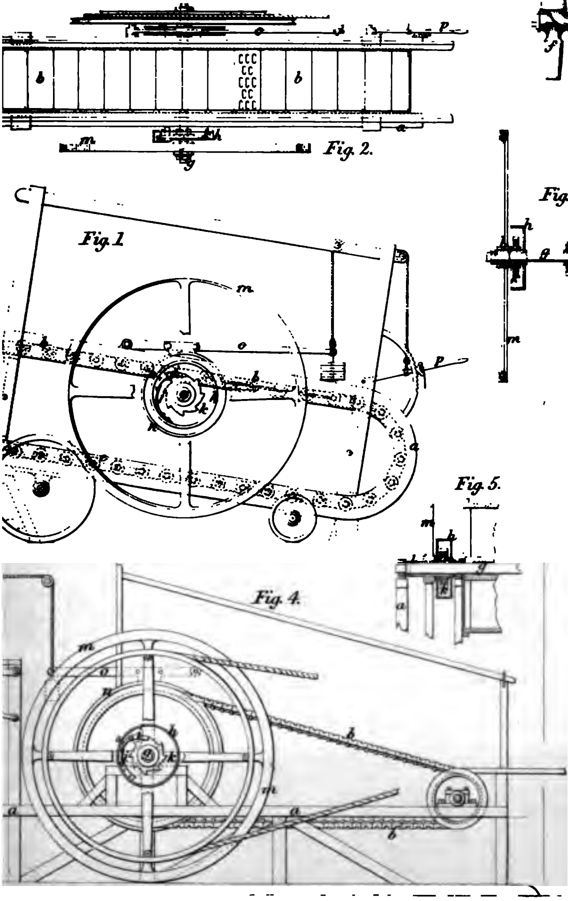
MacLardy's imp.d preparing & spinning mach.y

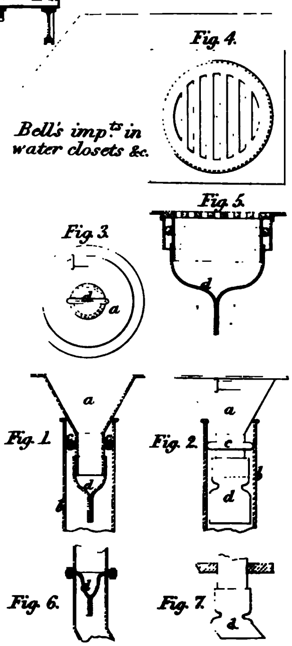


Forster's filter



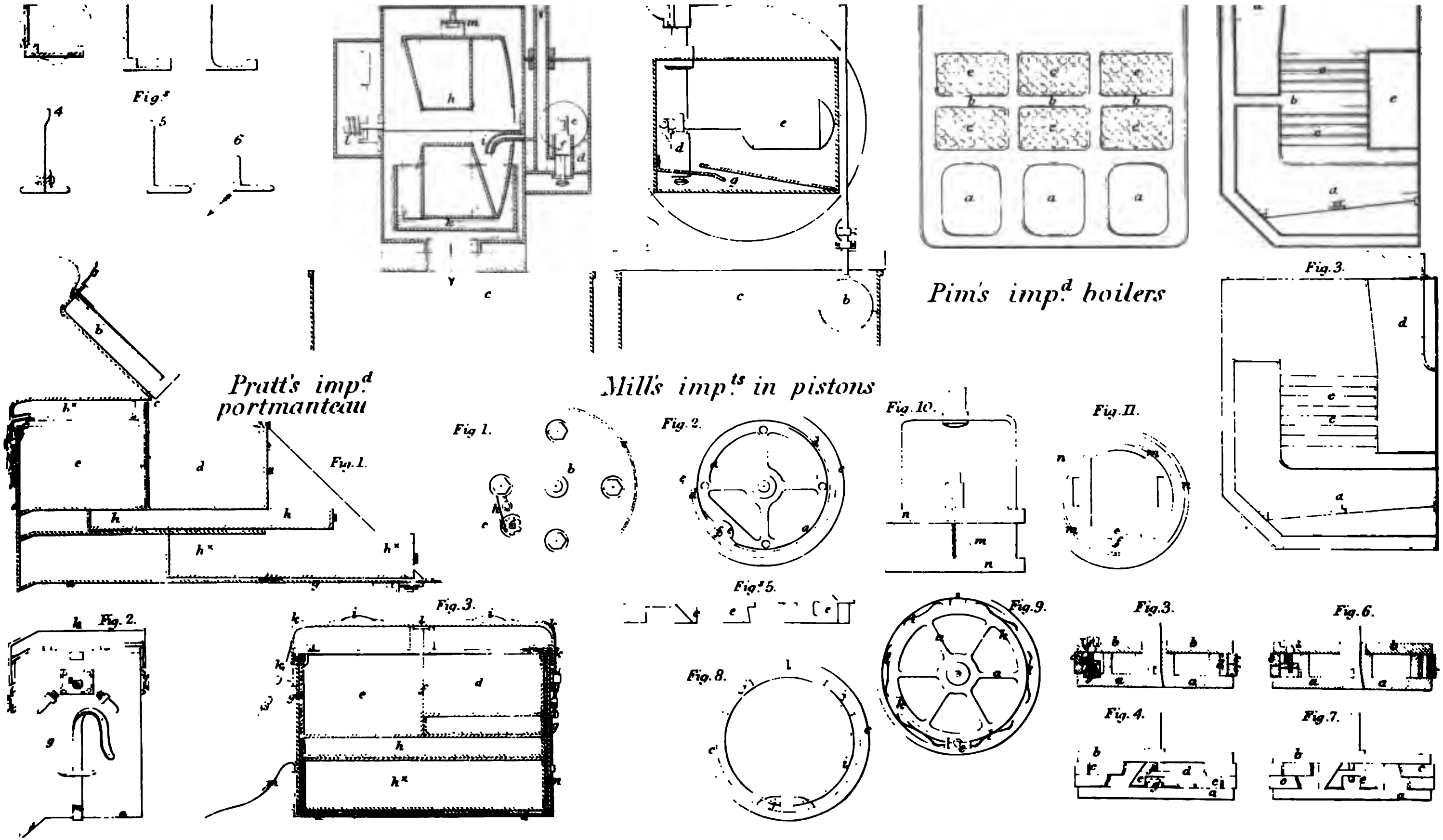
Hartas' motive power mach.y





1.st March 1851.

J.E.



Pratt's imp^d portmanteau

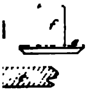
Mill's imp^{ts} in pistons

Pim's imp^d boilers

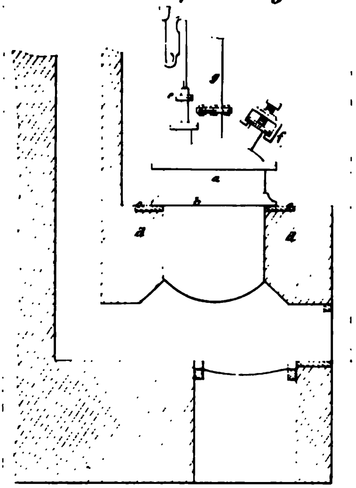
ı spinning.

Fig. 1.

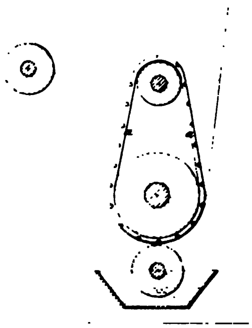
Fig. 2.



Rotch's soap boiling.



Christen's printing app.ts



Diagrams illustrating Mechan Engineers Transact.s

Fig. 2.

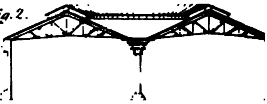
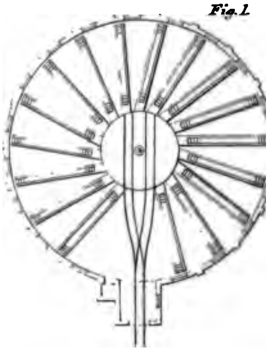


Fig. 1



...bronner's imp.ts in ...ling dust, &c. from rooms.

Fig. 1.

Fig. 2.

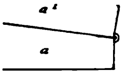


Fig. 3.

Fig. 3.

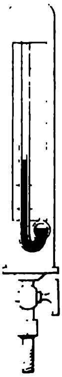


Fig. 4.

Horsfall & James' app.ts for rolling metals.

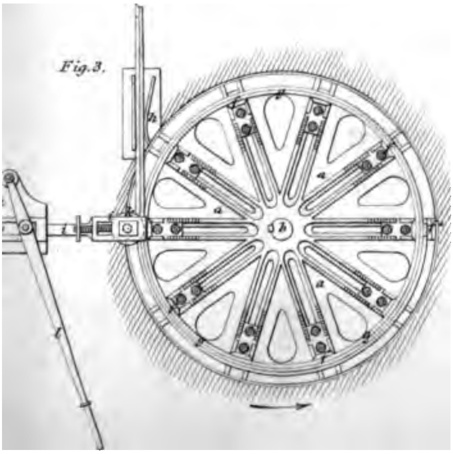
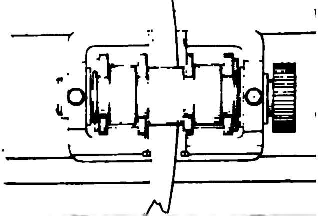


Fig. 2.



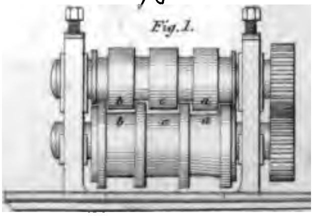
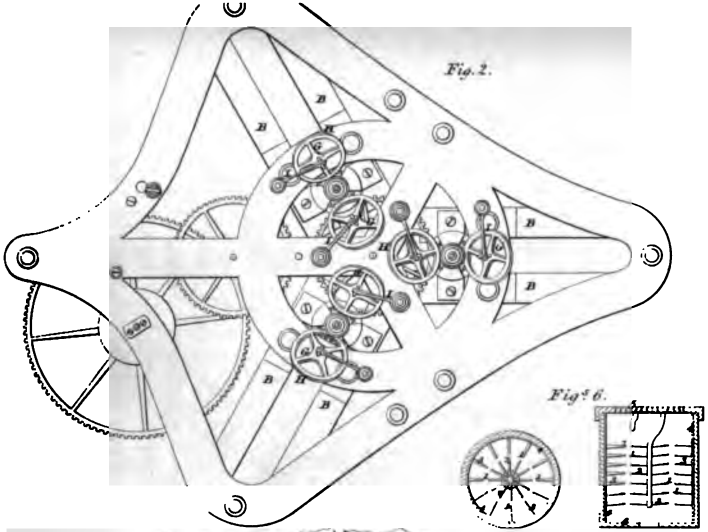
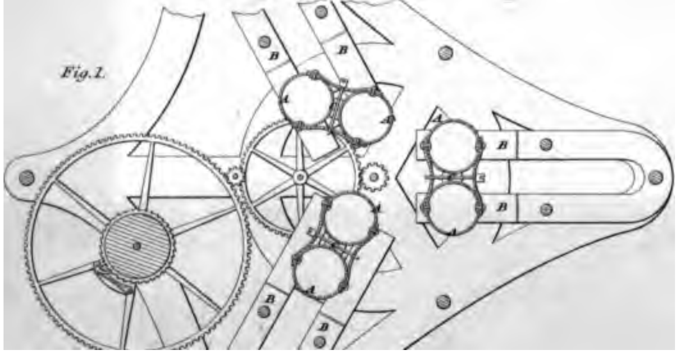


Fig. 2.



Figs 6.

Fig. 1.



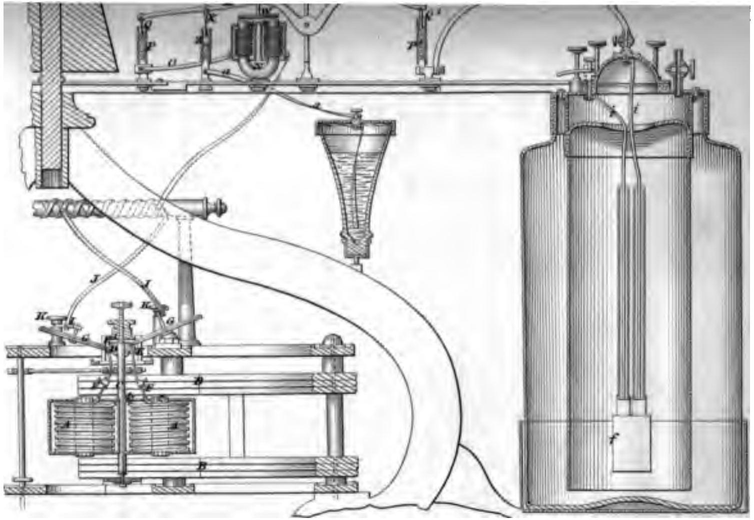


Fig. 4.

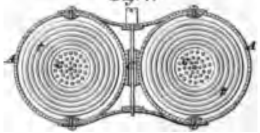
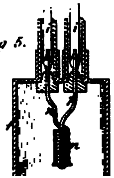
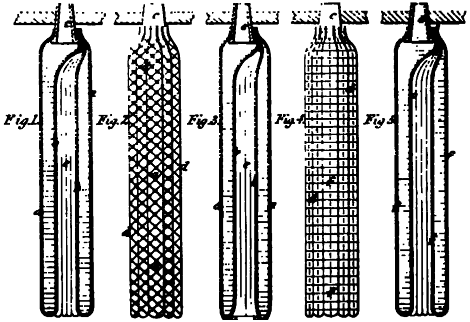


Fig 5.



Price & Whiteheads impd filters. –

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.



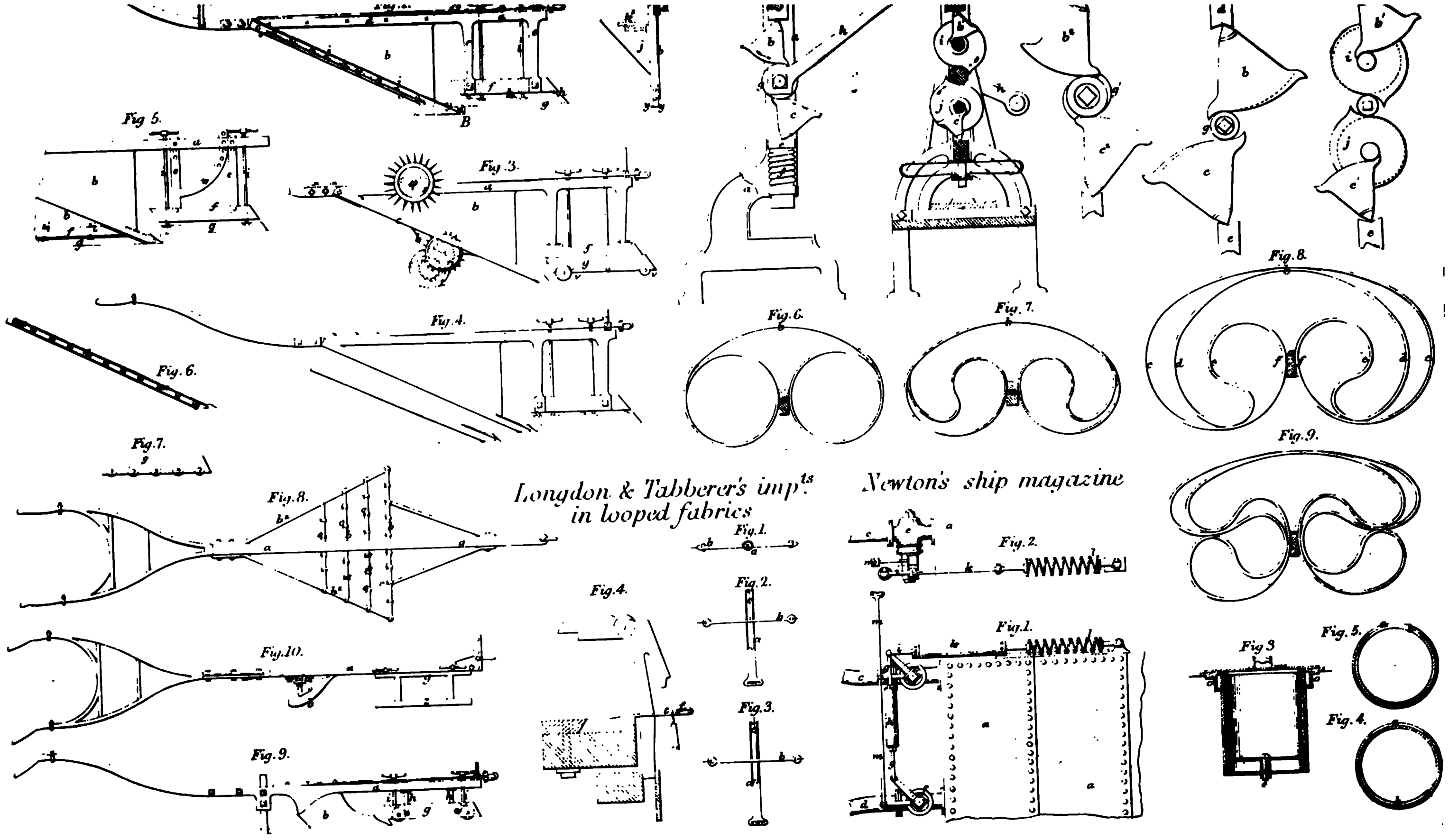
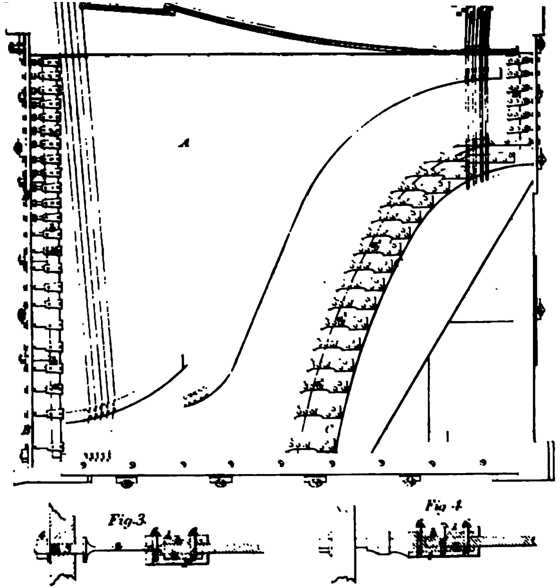
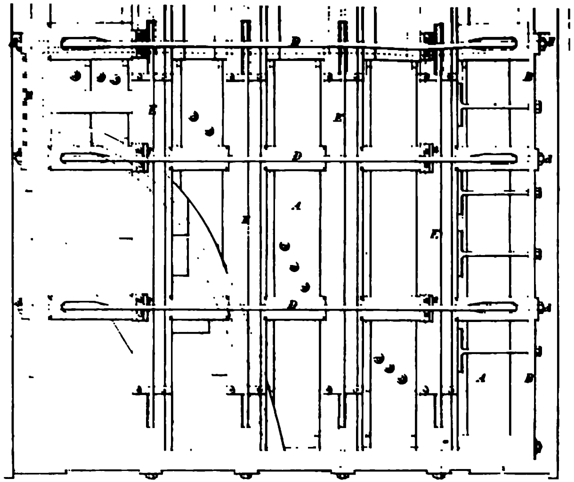
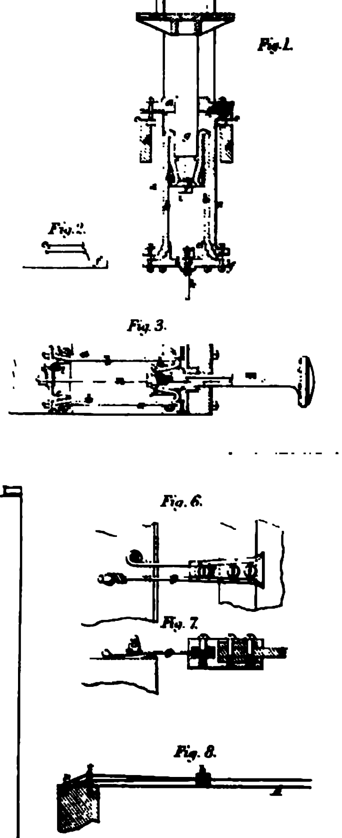
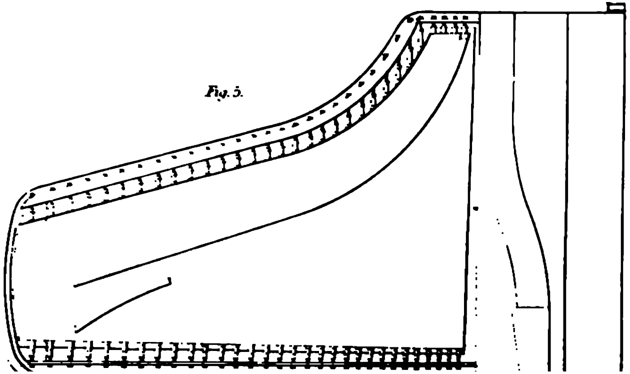


Fig 5.
Fig.3.
Fig.4.
Fig.6.
Fig.7.
Fig.8.
Fig.10.
Fig.9.
Longdon & Tabberer's impts
in looped fabrics
Fig.1.
Fig.2.
Fig.3.
Fig.4.
Fig.6.
Fig.7.
Fig.8.
Fig.9.
Newton's ship magazine
Fig.2.
Fig.1.
Fig 3
Fig.5.
Fig.4.

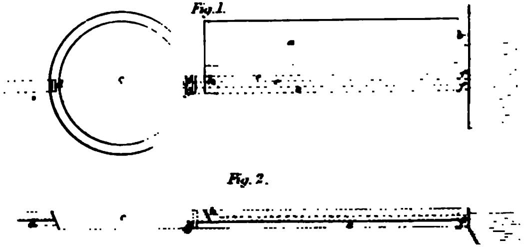


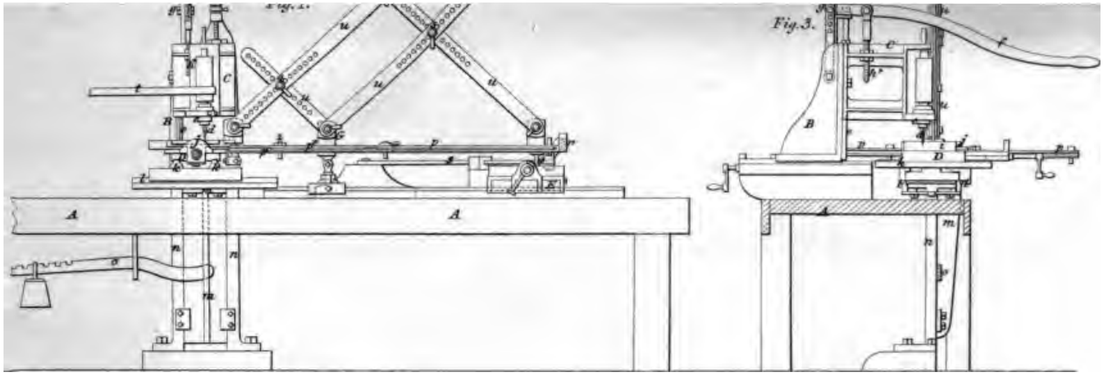


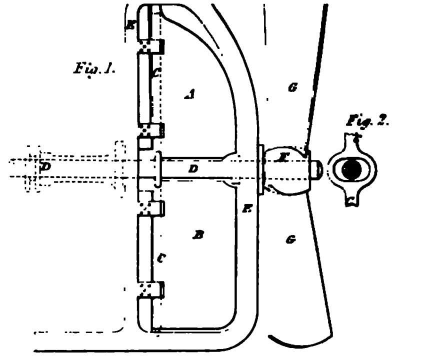


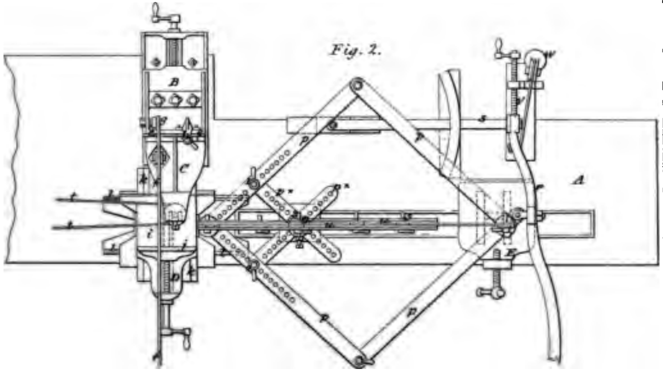


Page's imp^ts in cleaning sewers

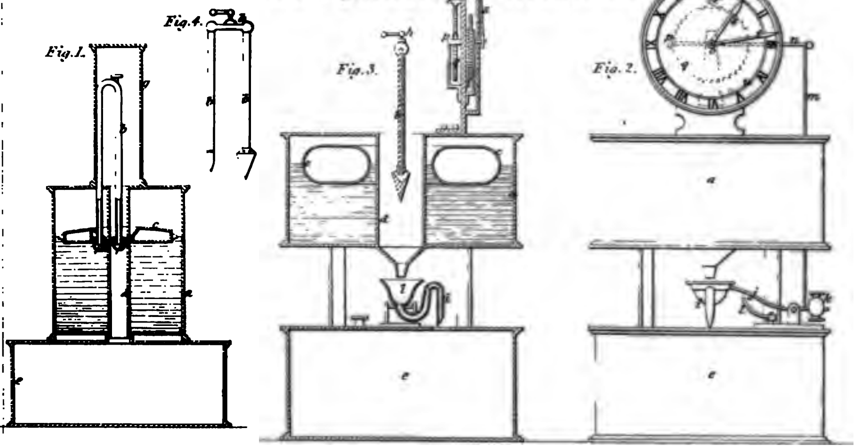


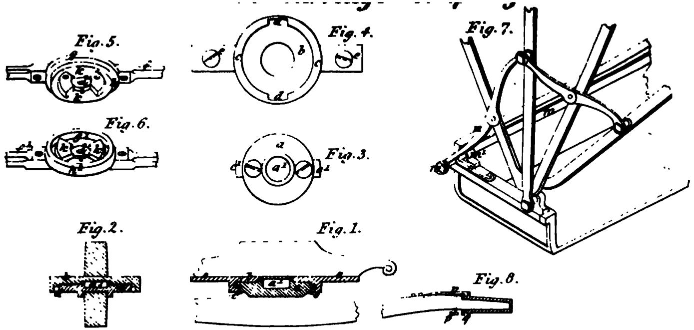


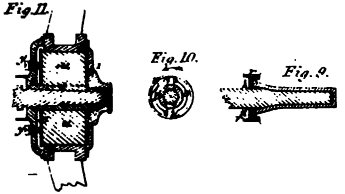




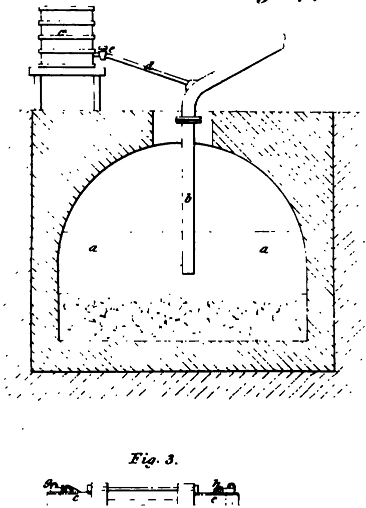
Tiffereau's hydraulic clocks.



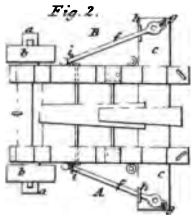


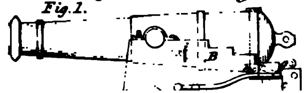


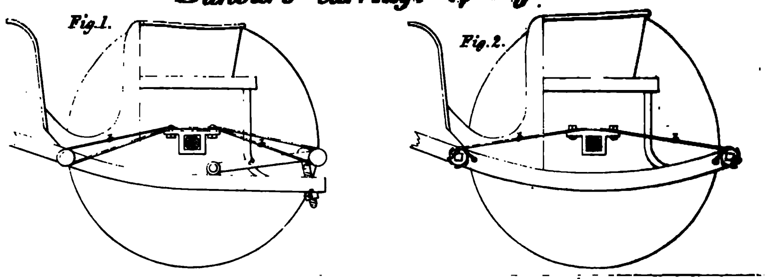
Browne's disinfecting app.ts



Howels' gun carriage.







Harratt's imp.ts in faggotting iron.

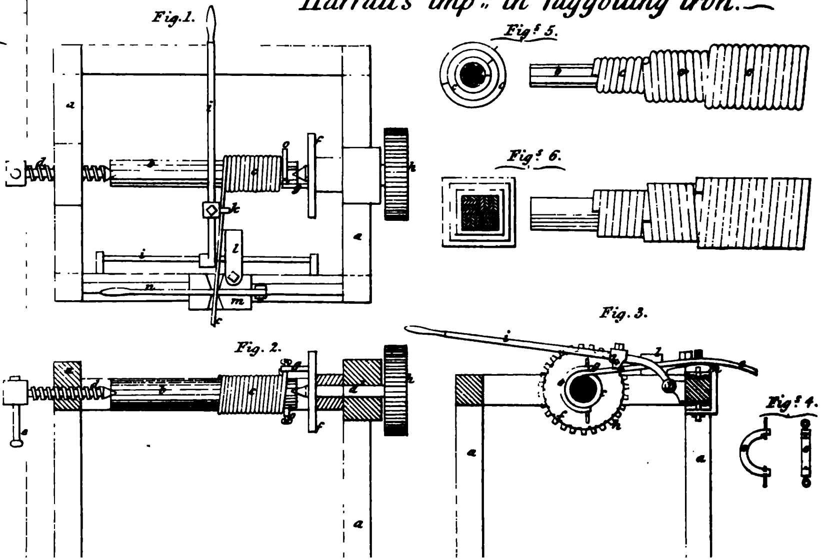


Fig. 1.

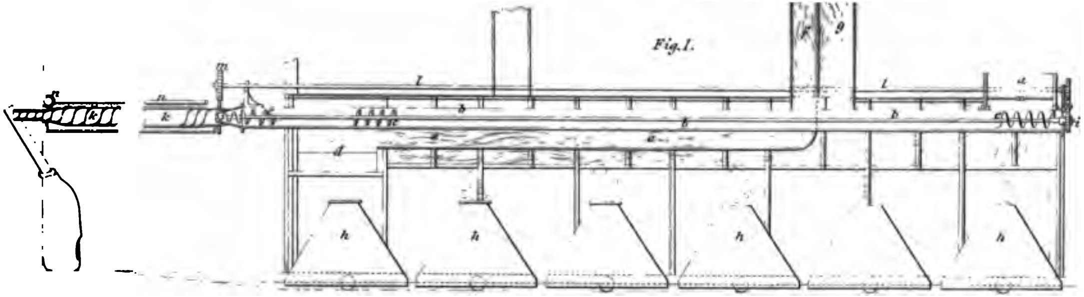


Fig. 2.

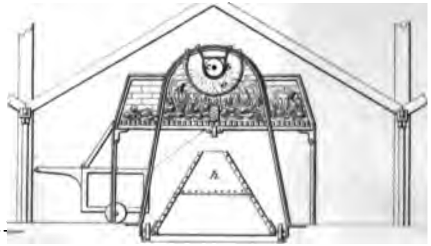
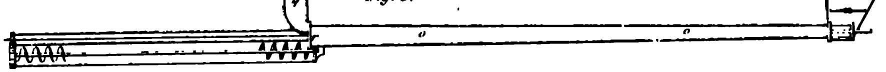


Fig. 3.



Newton's dyeing yarn.

Fig. 2.

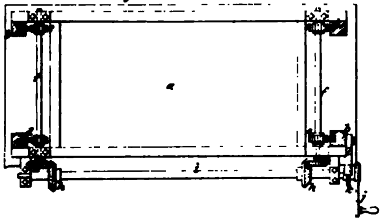


Fig. 4.

Fig. 1.

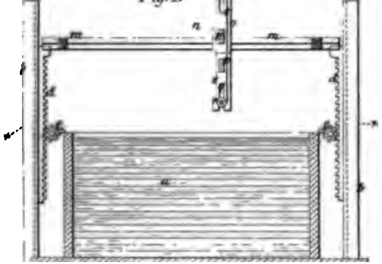
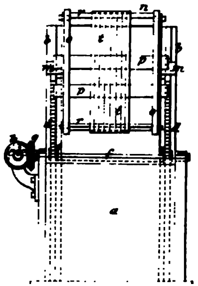


Fig. 3.



Illustrations of Mechanical Engineers Transactions.